[redacted]
Lubbock, TX 79412
February 19, 1992

Ms. Marjorie Dundas
Bureau of Alcohol, Tobacco & Firearms
650 Massachusetts Avenue NW
Room 5000
Washington, D.C. 20226

Dear Ms. Dundas:

Enclosed please find the materials needed to apply for an American Viticultural Area.

If you should need additional information or clarification of any of the material, please direct all correspondence to me as I am acting for the grape growers of the Texas High Plains area.

Thank you for your attention to this matter. I shall look forward to hearing from you.

Sincerely yours,

Clinton M. McPherson

Clinton M. McPherson
[redacted]
Lubbock, TX 79412
[redacted]

THE PROPOSED TEXAS HIGH PLAINS APPELLATION

The proposed viticultural area, "Texas High Plains" is located in north west Texas, on an elevated plains with approximately 12000 square miles. It covers the eastern half of the southern tip of the Great Plains (the western half is in New Mexico), with elevations between 3000 and 4000 feet (12). The area is rich in agricultural production of cotton, grains, peanuts, vegetables, sugar beets, fruits and cattle, often producing as much as 30% of the total agricultural income for the state of Texas. It is a flat, intensely cultivated area, with rich soils, underlain by the Ogallala aquifer which extends southward from Nebraska into Texas. Approximately 5 million acres on the Texas High Plains are irrigated from this aquifer. The land is table flat except where disturbed by erosion(3).

The Texas High Plains has become recognized as having a unique environment capable of producing the highest quality grapes and wines possible for Texas, with many wines from Texas High Plains grapes achieving high acclaims in national and international competitions. The excellent quality is attributed to the Texas High Plains high elevation, cool nights, rich soils, dry disease free conditions and constant breezes. These conditions make the Texas High Plains the coolest production area in Texas (9). It is also one of the highest production areas in the U. S. . At present nearly half (49.3%) of all commercial wine grapes grown in Texas are grown in the area known as the Texas High Plains (1). Many other wineries in Texas and New Mexico purchase grapes from the Texas High Plains because of perceived high quality potential (1).

I. Evidence that the area specified is known as the Texas High Plains

The area known today as the Texas High Plains is an extensive area bounded on the west by the Texas-New Mexico State line and on the east by the escarpment commonly known as the Caprock. It extends from the northern boundary of the Panhandle to south of Midland-Odessa. It is situated between 100° and 103° west longitude and 32° to 35°north latitude (3). It is a flat, gently sloping area with no major rivers, but potmarked by small lakes referred to as playas (12).

Some confusion may exist regarding the name, as early literature often referred to the area based on references to the

Spanish explorer, Francisco Coronado (2,4,5). He named a part of the area Llano Estacado which in English means Staked Plains. He found the Comanche Indians living here hunting the vast herds of buffalo which roamed the area. The "Llano Estacado" named by Coronado, included the southern part of the present day Texas High Plains and the eastern New Mexico Plains bounded on the west by an escarpment paralleling the Pecos River in New Mexico. The north escarpment defining the "Llano Estacado" is just north of Amarillo, Texas. Cummings (4), in his report on "Geography, Topography, and Geology" , fixes the date of Coronado's naming of the Llano Estacado at 1540.

Some questions arise concerning the early designation of the name. Conroy (5) limits the area defined as the Llano Estacado to 20,000 square miles. He also offers theories as to why that part of the Texas and New Mexico High Plains was originally called Llano Estacado. These include: (a) the name originated from the practice of the explorers or Indians marking trails across the featureless plains with buffalo chips, bones, or stakes driven into the ground; (b) the plains were so called because of the rampart-like or palisaded appearance of its northwestern escarpment in New Mexico ; and (c) Llano Estacado is a New Mexican corruption of Llano Destacado- the frontier meaning of which was "elevated " plain, not staked plain. The last seems very likely in that the Spanish translation of destacado is "to stand out clearly, excel or be elevated", a more likely first impression by the Spanish explorer as he first crossed the area, since it is surrounded by an escarpment on all sides. These plains were for the most part left to the Comanches and Mescalero Apaches until the late 1880s.

In more recent development and writings about the area, it is referred to as the Texas High Plains (1, 2, 3, 9,10,12,13,14,15,16,17,18,19,20,21). According to the Texas Almanac, "The Texas High Plains is a 20,000,000 acre extension of the Great High Plains to the north. A Caprock escarpment is the dividing line between the High Plains and the lower Rolling Plains to the east. The Caprock is an east facing mountain wall from the Red River southward through Briscoe, Floyd, Motley, Dickens, Crosby, Garza and Borden Counties "(12).

History books used in public schools (18) referred to the High Plains as "the great American desert" in early days, but later realized the importance of the area after irrigation was established in the 1940s. Thereafter they teach "much of West Texas is on the High Plains" and "half of the irrigated land of Texas is on the High Plains".

Texas, Land of Contrast (19), published by the travel and information division of the Texas Department of Highways provides detailed maps (included in the appendix) of the Texas High Plains which extends from the northern limits of the Panhandle to just south of Lamesa and Seminole, Texas. It includes some territory east of the Caprock, but lower in elevation than the Plains above the Caprock.

Scientific publications unanimously utilize the "Texas High Plains" designation in describing soils, water, irrigation and related agricultural research studies. Sweeten and Jordon of the Texas Water Resources institute conducted a study on "Irrigation water management for the Texas High Plains". In their study, they define the area, crops, rainfall, aquifers,etc. including maps (see Appendix) of the High Plains areas. Gerik and Harris (14) in discussing conservation tillage, describes the soil conditions and farming practices on the Texas High Plains. They also include maps defining the boundaries (included in appendix). The Texas Water Development Board, in developing "the Texas Water Plan (15), provides map (included in the appendix) defining the Texas High Plains, and indicating the location of the Ogallala aquifer which provides irrigation water for the Plains. Lipe et al. (21) publishes an annual report on "Grape Cultivar/Rootstock performance on the Texas High Plains, in recent years from the Lubbock and Halfway stations. The Halfway station is the former High Plains Research Foundation. Conclusions reached by Perry and Bowen (9) in their feasibility study for grapes in Texas in 1974, were that the three areas having greatest potential for wine grape production in Texas were the Texas High Plains, the Texas Hill Country (already an appellation) and the Trans-Pecos. All maps used by the Texas Wine and Grape Growers Association define the area of north-west Texas as Region 1, the High Plains Region.

A final, most important group of evidence is provided by wine journalists. In reporting on award winning wines, journalists often refer to the appellation of the grapes. Such articles as "Grapes may become a vintage crop for the Plains" from Texas Farmer-Stockman(16), "The wine industry- coming of age in Texas"(17), and "High Plains vintner industry leader", refer to the importance of the county or the area as the source of premium grapes. In an article in Greater Lubbock(22) the author states "Lubbock's 2 wineries accounted for the only Gold medal awarded, 60% of the Silver and 40% of the Bronze. It goes on to define the many factors entering into quality and concludes that environment (soil, water, and climate) plays the most important role. In all of the above

reverences, as well as many others that could be included, the authors referred to the Plains or High Plains even though the wines were labeled "Lubbock County" or "Texas". In most cases it is understood that the area being referred to is the Texas High Plains . Other Texas wineries have also won awards on grapes grown on the Texas High Plains, although they too referred to them by county or vineyard owners name. The ultimate recommendation for the use of the Texas High Plains as the appellation for this area came after two Lubbock County wines won prestigious awards in San Francisco. Even though they were labeled "Lubbock", many reports from wine writers, about the competition, stated " Texas High Plains Wines score high marks" (John Lowey, personal communications)(25).

II EVIDENCE THAT THE PROPOSED BOUNDARIES ARE CORRECT

Viticultural History - The earliest evidence of efforts to grow grapes on the Texas High Plains comes from the records of the Texas Agricultural Experiment Station in Lubbock, where reports from 1909 to 1937 (20) indicate the adaptability of many cultivars including Vitis vinifera at that station. The work was apparently dropped in 1937(no further reports) as the Station began to focus its research on the major crops for the area. Old timers such as J. H. Dunn, North of Lubbock (now deceased) observed the research at the Lubbock Experiment Station and later grew grapes commercially from 1945 to 1974 . Mr. Dunn and others in the Abernathy Chamber of Commerce were instrumental in getting the Chamber in 1968 to provide a financial grant to the Texas Agricultural Experiment Station to determine the feasibility of growing wine grapes commercially on the Texas High Plains.

Simultaneously in the 1950's Dr. W. W. Yocum, of Texas Tech University planted French-American hybrids, American and vinifera cultivars in research plots at Tech. They were lost 10 years later due to expansion of the University (no publications exist), but some vines were salvaged by Bob Reed of Texas Tech and the production of these vines encouraged Reed and C. M. McPherson, also of Tech to begin making wines and eventually to plant an experimental vineyard south of Lubbock with approximately 150 cultivars. Their efforts as well as those of Dunn's and the Texas Agricultural Experiment Station, indicated the potential for wine grape production on the Texas High Plains.

The next step was the establishment of a commercial grape growing industry on the Texas High Plains. This came in 1973 when

McPherson and Reed called a meeting of interested parties to discuss the commercial planting of grapes in the area. An enthusiastic group listened to presentations from McPherson, Reed, Lipe (TAES) and others, and after assurance from McPherson that a winery would be built, committed to planting vineyards in the spring of 1974. Approximately 120 acres of French-American hybrid grapes were planted in 1974, a large part by the Sandy Land Grape Growers Association from the Morton-Whiteface area.

In the intervening years before the first harvest, Mrs. Jean Dorn of San Antonio, Texas became interested in the potential production of wine in the area and contributed the initial money for the construction of the first winery. McPherson became the first president of the project and was responsible for acquiring the appropriate licenses and naming the first winery on the Texas High Plains, "Llano Estacado". The first crush for the new winery was in 1976. Three additional wineries have since been developed on the Texas High Plains, Pheasant Ridge, Teysha, and La Escarbada XIT.

Since that time plantings have changed from French-American hybrids to vinifera and acreages have expanded to 2000 acres planted by 1990. Only about 1332 acres were in production at that time with the remainder being young vineyards(1). Commercial vineyards now exist over a large part of the Texas High Plains with significant plantings in Lubbock, Hale, Floyd, Crosby, Lynn, Dawson, Lamb, Hockley, Gaines, Yoakum, Terry, and Cochran counties and smaller vineyards in Garza, Swisher, Castro, Parmer, and Randal Counties(21). The only counties included within the proposed appellation boundaries which do not presently have commercial vineyards are Bailey, and parts of Brisco and Armstrong counties above the Caprock edge. The growing conditions in these three counties are not unlike those in neighboring counties included within the boundaries.

The rationale for establishment of the proposed boundaries evolved over the past 20 years from observations of vineyard performance in each of the counties named as well as from the accumulation of research (21), topographical (USGS) and meteorological data (9). It was observed that risk from freeze damage became intolerable along the New Mexico border on the west and in counties along the northern limits of the proposed boundaries. Meteorological data indicates that extreme minimum temperatures during the winter are approximately 10° F colder along the west and north boundaries compared to Lubbock(9). Topographical data from USGS maps indicates that the elevation along the proposed west and northern boundaries approximates 4000 feet. Due to the

combination of vineyard performance, extreme low temperatures and high elevations, it was determined that efforts to grow grapes beyond the proposed boundaries on the west and north would not be economically profitable due to frequent vine loss, even though wine quality would be equal or better in those areas due to the lower heat summations. As a result, the Texas-New Mexico state line approximating the 4000 foot elevation line and the Sante Fe Railroad line from Farwell, Texas to Canyon, Texas and thence Texas highway 217 to the Caprock edge, defining the northern limits of economic production, were chosen as the west and northern boundaries respectively.

The eastern boundary of the proposed appellation was no problem. The Caprock escarpment provides an east facing wall 200-1000 feet high along the entire east boundary of the proposed appellation(12), separating the Texas High Plains from the Rolling Plains to the east. The elevation on top of the Caprock along the escarpment wall is 3000 feet(USGS map). This boundary also approximates the 61° F mean temperature isotherm further indicating major differences in climate between the two areas. The edge of the Caprock is evidence of major erosion which extends into the area below the Caprock. The soils east of the escarpment are shallow, highly eroded and lacking in fertility especially along the northern extremes of the Caprock. What soils do exist below the Caprock , are infected with Cotton Rootrot (not found on the High Plains) which requires the use of the vigorous Dogridge rootstock. All of these factors (temperature, elevation, and disease incidence) combine to produce grapes of lower quality than possible on the High Plains.

A similar situation occurs for the southern boundary. The proposed boundary(U.S. Highway 180) approximates the 61° F mean temperature isotherm, but more importantly is the southern limit of highly productive agricultural land on the Texas High Plains. South of U.S. Highway 180 soils are light shallow sands, highly eroded by wind (most have been removed from dryland farming) and lack the water needed for grape production. Although a few productive farms do exist south of this boundary, especially along the New Mexico border, none have shown interest in planting grapes. One vineyard planted under these conditions was later abandoned because the vineyard caused the accumulation of drifting sand and became the site of an eventual sand dune.

The Texas High Plains area has had great viticultural success. In the feasibility study made in 1974 by Ron Perry and H. Bowen of the Texas Agricultural Experiment Station (9), The Texas High Plains

was determined to have the greatest potential for grape production of any area of Texas. This conclusion was based upon meterological data(9,10,12) such as heat summation(9,11), first and last freeze dates(9), mid winter extreme temperatures(9), hail(9), winds (9), rainfall(7), soils(12,14), available irrigation water(8,13,15), freedom of disease etc. (9). In all of these parameters except mid winter extreme temperatures, the Texas High Plains has excelled compared to other potential areas of Texas. The key parameter responsible for the excellent award winning wines coming from the area is the low heat summation during the growing and ripening seasons. In a nutshell, the Texas High Plains is the coolest area of the state, has the least disease problems, the best soils and thus produces the highest quality grapes most economically.

III. EVIDENCE THAT THE GEOGRAPHICAL FEATURES OF THE AREA PRODUCE GROWING CONDITIONS WHICH DISTINGUISH PROPOSED AREA FROM SURROUNDING AREA

The difference between the Texas High Plains and the surrounding area is summed up by the words of the Spanish explorers after traveling across this land. They called it Llano Destacado. The word destacado means "to stand out clearly, excel or be elevated", thus, the Elevated or High Plains. From every direction except the proposed northern boundary, the High Plains is instantly recognized from the surrounding lands.

Topographically, the Texas High Plains is 200-1000 feet higher in elevation than the Rolling Plains to the east(12) and is separated by a distinct wall escarpment called the Caprock. Although the same escarpment occurs on the west, it is in New Mexico and the proposed boundaries for this appellation stop at the state line which approximates the 4000 foot elevation level. Commercially feasible production is limited beyond this point due to excessive risk from freeze injury.

On the south, the topography also changes noticeably. South of Lamesa (on U. S. 180), land once cultivated in dryland cotton has been abandoned due to sand hills formed by high winds and erosion. The topography changes quickly from intensely cultivated land to short grasses, scrub brush and sand hills.

On the north is the exception to the "stand out" theory. Here the proposed boundary is defined by temperature (partially as the result of elevation exceeding 4000 feet, and partially due to northern latitudes). This change is not readily noticeable, but none-the-less

important to those would-be growers who have abandoned earlier plantings due to frequent freeze loss.

Soils over the area vary from north to south. In the northern part of the proposed Texas High Plains appellation, the surface horizon is composed predominantly of brown clay loams with clay textured subsoils(14). In the northwestern areas they become sandy loam textured. They are mostly gently sloping and subject to wind erosion in the northwest and water erosion along breaks into drainageways. As one moves south, the soils become lighter with fine sandy loams in the central and east central regions and fine sands in the south, southwest and western counties (14). The subsoils in the latter vary with caliche(various compositions of sand and clays) at varying depths. All are gently sloping with 9-10 feet per mile from north to south and from west to east (4). These soils were originally built up from the uplifting of the Rocky Mountains (12). Shifting of soil due to wind and water erosion has contributed to soil depth in many areas.

The area is semi-arid, transitional between the desert conditions on the west and the humid climates to the east and southeast(10). The greatest monthly rainfall totals occur from May through September when warm moist tropical air may be carried into the area from the Gulf of Mexico. This air mass often brings moderate to heavy afternoon and evening thunderstorms, accompanied by hail. Precipitation across the area is characterized by its variability. Since 1911 rainfall means have been 18.62 inches at Lubbock and 20.19 at Amarillo.

Snow may occur from late October until April. Each snowfall is generally light and seldom remains on the ground more than two or three days at any one period.

High winds are associated primarily with intense thunderstorms and at times may cause significant damage to structures. Winds in excess of 25 mph occasionally occur for periods of 12 hours or longer. These prolonged winds are generally associated with late winter and springtime low-pressure centers. Spring winds often bring widespread dust causing discomfort to residents for periods of several hours.

Overall, the climate of the region is rated as pleasant. Most periods of disagreeable weather are of short duration. The summer heat is not considered oppressive. One moderating factor is a variable, but usually gentle, wind. Low relative humidities often reduce any discomfort from the summer heat.

The average first freeze date is the first of November, and the average date of the last freeze is in mid April(10), after normal

budbreak. Mean temperatures across the area vary from 61° F on the south and southeastern boundaries of the proposed appellation to 57-58 ° F on north. The 61° F isotherm was instrumental in determining the southern boundary. Heat summation data is considered important in determining the quality potential of wine grapes (11). Degree-day heat summations for the Texas High Plains are the lowest in Texas(9) and vary from 3800 to 4400 from year to year at Lubbock (21). They are lower as you go north and higher as you go south or east. For each degree increase in mean temperature, you have an increase of 365 degree days(24). There is a considerable increase in heat summation south and southeast of the proposed boundaries.

As already discussed, the major criteria for separating the Texas High Plains from areas west and north of the proposed boundaries is extreme minimum temperatures and freeze injury to vines. Winter low temperatures from most of the proposed appellation are 0 to 10° F whereas at Amarillo, north of the proposed region, mid winter lows are - 10 to 0 ° F (9).

Another major distinction between the High Plains and surrounding areas is in soils, especially on the east and south. East of the Caprock, the elevation drops 200 to 1000 feet, due to erosion and the soils below the Caprock are shallow, highly eroded, poor soils. South of the proposed appellation, soils change from sandy loams with good depth to shallow sands, highly wind eroded.

Available water is another important distinction. The Ogallala aquifer which provides most of the High Plains with water ends near the proposed southern boundary, giving little or no water to most of the land south of the proposed boundary. Although the aquifer extends to the east of the Caprock, finding water off the Caprock is difficult and usually of small quantities, and then only from shallow, unproven local aquifers.

A final difference, and yet one of the most important is in relative humidity and its effect on disease. Because of the low relative humidities on the High Plains, the incidence of bunch rot, downy mildew, Pierces disease, and black rot are minimum on the Texas High Plains(21) compared to areas just off the Caprock to the east. Another important disease difference is that of cotton rootrot. It is found just below the Caprock, but not on the High Plains(9). An insect pest, phylloxera, also is native to most of Texas except the High Plains. The lack of trees and native grapevines on the High Plains may be a contributing factors to the lack of certain disease and pest problems above the Caprock.

IV. NARRATIVE DESCRIPTION OF THE BOUNDARIES BASED ON FEATURES WHICH CAN BE FOUND ON A U. S. GEOLOGICAL SURVEY MAP OF THE LARGEST APPLICABLE SIZE AND SCALE

The boundaries of the proposed Texas High Plains appellation are defined as follows: Starting at the southeast corner on Map#1 (NI 14-10, entitled "Big Spring", start on U. S. Highway 180 as it enters Dawson County from the east, at the 3000 foot level, continue west through Dawson County and Gaines County (changing to Map #2 (N1 13-12, entitled Hobbs), to the state line. Proceed north along the Texas-New Mexico state line [changing to Map #3 (NI 13-9 entitled Brownfield) and Map #4 (NI 13-6 entitled Clovis)]. You will pass from Gaines County, cross Yoakum County, Cochran County, Bailey County and enter Parmer County. Continue to Farwell, Texas where the Santa Fe Railroad crosses the State line. Follow the railroad northeasterly across Parmer County,(changing to Map #5 (NI 14-4 entitled Plainview), Deaf Smith County to Canyon, Texas in Randall County. From Canyon follow Texas Highway 217 to the canyon brakes where the elevation reaches 3000 feet. Follow the 3000 foot level in a southerly direction along the Caprock brake across Armstrong, Briscoe, Floyd [changing to Map #6 (NI 14-7)],Crosby, Lubbock, Lynn and Dawson Counties until the point of origin is again reached on U. S. Highway 180 at the 3000 foot level. Terry, Hockley, Lamb, Castro, Swisher and Hale Counties are included with the area as well as the afore mentioned border counties.

V. MAPS MARKED WITH COLOR

The green lines placed upon the map designate the mean temperature. The blue line designates the 3000 foot contour line and area which is being proposed for designation as the Texas High Plains Appellation.

The Texas High Plains Appellation is formed beginning at:

1. Lamesa, Texas - Map #1 (NI 14-10) entitled Big Spring. Go west on U. S. Highway 180 indicated by the blue marker.
2. Go to Map #2 (NI 13-12) entitled Hobbs, New Mexico-Texas. Continue on U. S. Highway 180 to Seminole and thence to the Texas-New Mexico state line. Commence going north along the state line.
3. Go to Map #3 (NI 13-9) entitled Brownfield.
4. Proceed to Map #4 (NI 13-6) entitled Clovis, New Mexico-Texas stopping at Farwell on the state line. The follow the Atchison-

Topeka, Santa Fe-Southern Pacific Railroad through Bovina, Hereford and on to Canyon, Texas.

5. State Highway 60 parallels the railroad found on Map #5 (NI 14-4) entitled Plainview. Follow Texas Highway 217 east out of Canyon to reach the escarpment where the elevation drops to 3000 feet. Follow the 3000 foot contour line southward along the escarpment.
6. Go to Map #6 (NI 14-7) entitled Lubbock.
7. Then return to Map #1 (NI 14-10) and go to the point of origin at Lamesa, Texas.

The area enclosed by the blue marker is the area of the proposed Texas High Plains Appellation.

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1. The Market Report, Texas Wine Marketing Institute.
2. The Texas High Plains - Texas Highway Dept. Historical Marker.
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Fall 1991

The Market Report

Research & Information for the Wine Industry Vol. 1, No.5

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Wine Marketing
Research Institute
Texas Tech University

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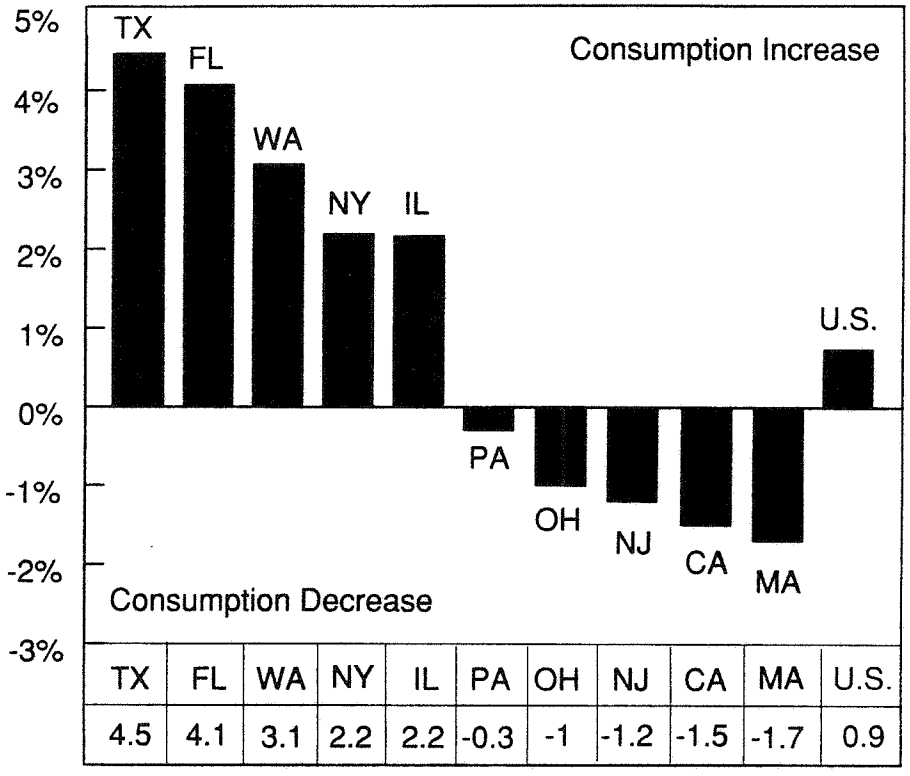
IN THIS ISSUE:

Percent Change in Table Wine Consumption 1989 to 1990 for Top Ten U.S. Markets



TX	FL	WA	NY	IL	PA	OH	NJ	CA	MA	U.S.
4.5	4.1	3.1	2.2	2.2	-0.3	-1	-1.2	-1.5	-1.7	0.9

% Change

Source: TX Wine Marketing Research Inst., Texas Tech University and Jobson's Handbook 1991

Texas Wine Consumer Survey Results

The Texas Wine Marketing Research Institute recently surveyed wine consumers within the state of Texas. The aim of the survey was to help the industry better understand wine buying patterns, frequency of consumption and attitudes and perceptions of consumers towards wine.

The survey was sent to 4,254 wine consumers within the state of Texas during July, 1991 and a 20 percent response rate was achieved from these consumers. The following graphs and tables detail some of the major results from the survey.

Place of Purchase

Table 1 indicates that wine consumers most frequently purchase wine at the liquor/wine store with frequent purchases also made at restaurants and bars. Purchases from wineries do not constitute a substantial percentage of wine sold to these consumers as 88.1 percent of consumers purchase 10 percent or less of their wine from this source.

Percentage of Time Wine Purchased at Various Locations (Table 1)

	Percentage of Time Purchased						
Location	0-10%	11-20%	21-30%	31-40%	41-50%	51-100%	No Response
Restaurant/Bar	34.8	17.9	11.9	10.4	15.4	8.6	1.0
Grocery Store	68.7	8.6	5.3	5.9	4.3	6.2	1.0
Liquor /Wine Store	11.5	6.5	8.3	10.3	18.9	44.5	1.0
Winery	88.1	3.2	3.0	2.4	1.3	0.7	1.3

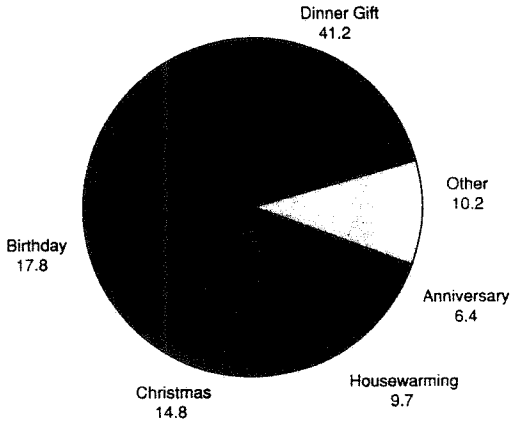
With regard to purchasing wine, consumers were asked how much more or less they would be willing to pay at a restaurant compared to a grocery store or liquor store. Not surprisingly, nearly 90 percent of respondents said they were willing to pay more at a restaurant, however, there was no indication as to how much more they would pay. When comparing grocery stores with liquor stores, consumers would be prepared to pay less for the same wine purchased at a grocery store.

Purchase of Wine as a Gift

Seventy-six percent of respondents noted that 10 percent or less of their wine purchases were for gift giving. The main basis for the selection of wine as a gift was the person's preference followed by the wine variety, price, the region and recommendations by clerks and through publications.

Figure 1 indicates that the purchase of wine as a dinner gift is by far the largest occasion when wine is purchased as a gift. This is followed by birthdays, Christmas and housewarmings.

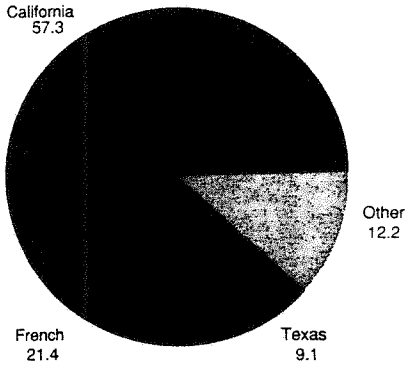
Occasions When Consumers are Most Likely to Purchase Wine as a Gift (Percent) (Figure 1)



Source: TX Wine Marketing Research Inst.

The type of wine purchased for giving shows California wine to be the most popular type followed by French and Texas wine.

The Type of Wine Most Likely to be Purchased for Gift Giving (Figure 2)



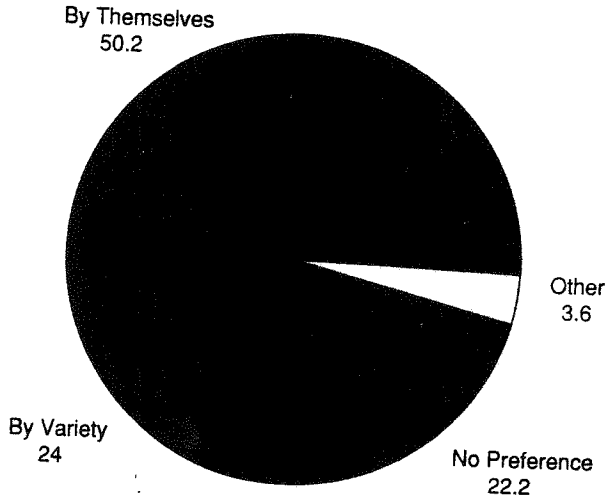
Source: TX Wine Marketing Research Inst.

Texas Wine

Around 14 percent of respondents said they would never buy a Texas wine when choosing a wine from the United States. With regard to frequency, 5.3 percent said they purchased Texas wine at least 50 percent of the time. Eighty percent of respondents noted that they purchased Texas wines 10 percent or less of the time they purchase wine.

Consumers were also asked how they would prefer Texas wines to be displayed in liquor and/or wine stores. (See Figure 3)

How Consumers Believe Texas Wines Should Be Displayed in Liquor/Wine Stores (Figure 3)



Source: TX Wine Marketing Research Inst.

Information Concerning Wine

Respondents indicated a variety of sources of information concerning wine (the question allowed each person to make more than one choice from the sources listed). Magazine articles were by far the most common source of information followed by friends and family, winery tours, and in-store staff.

Where Consumers Get Information About Wine (Multiple Answers) (Table 2)

Source	Percentage
Wine Journal/Magazine Articles	71.1
Friends/Family	49.5
Winery Tours/Visits	42.7
In-Store Sales Staff	39.9
Wine Classes/Tastings	38.0
Newspaper Wine Writers	37.2
Winery Newsletters	31.3
Restaurant/Servers	20.3
In-Store Promotions	11.8
Wine Journal/Magazine Advertising	11.8
Other	9.6
Newspaper Advertising	4.2
Television Commercials	2.7

Source: TX Wine Marketing Research Inst.

Producing Wine Grape Acreage, Production and Value of Production

Texas grape growers reported 2,700 producing acres of wine grapes during the 1990 season with a total wine grape production of 3,942 tons. Untimely freezes cut production short in many areas, and during 1990, yield averaged 1.46 tons per acre.

Value of production of all wine grape varieties averaged $800 per ton with a total value of $3,130,423.

Cabernet Sauvignon was the most popular variety of producing wine grapes with 547.9 acres, 20.3 percent of the total producing acreage. Chardonnay with 515.1 acres accounted for 19.1 percent, and Sauvignon Blanc with 442.5 acres had 16.4 percent of the total producing acreage.

Chenin Blanc represented 13.4 percent of the total producing acreage; Riesling, 7.1 percent; and Cabernet Franc, 4.3 percent.

Chenin Blanc was the highest yielding variety of wine grapes, averaging 2.77 tons per acre. Total production of Chenin Blanc was 1,004.7 tons, 25.5 percent of the total.

Texas producers harvested 702.6 tons of Sauvignon Blanc with an average yield of 1.59 tons per acre, while Chardonnay production totaled 623.2 tons with an average yield of 1.21 tons per acre. Of the total state wine grape production, these varieties accounted for 17.8 percent and 15.8 percent, respectively.

Texas Commercial Wine Grape Vineyards, 1990
Producing Acres, Production, Price and Value

Wine grape variety	Producing acreage				
	Producing	Yield per acre	Production	Price per ton	Value of production
	Acres	Tons	Tons	Dollars	Dollars
Barbera	89.3	2.44	218.1	550	119,955
Cabernet Franc	114.8	0.80	91.5	1,091	99,827
Cabernet Sauvignon	547.9	1.09	597.3	1,052	628,360
Chardonnay	515.1	1.21	623.2	1,151	717,303
Chenin Blanc	362.8	2.77	1,004.7	558	560,623
French Columbard	36.2	1.88	67.9	574	38,975
Gewurztraminer	33.7	1.38	46.5	650	30,225
Lenoir	37.5	0.73	27.2	500	13,600
Merlot	60.7	0.64	38.9	943	36,683
Muscat Canelli	30.2	1.35	40.9	775	31,698
Petite Siran	16.6	0.84	14.0	625	8,750
Pinot Noir	54.7	1.15	63.1	1,055	66,571
Riesling	190.7	1.02	194.8	600	116,880
Ruby Cabernet	43.3	1.82	78.9	553	43,632
Sauvignon Blanc	442.5	1.59	702.6	778	546,623
Semillon	29.7	0.70	20.7	728	15,070
Zinfandel	46.4	0.98	45.7	683	31,213
Other varieties 1/	22.4	1.71	38.3	638	24,435
Unknown varieties	25.5	1.09	27.7	--	--
TOTAL	**2,700.0**	**1.46**	**3,942.0**	**2/800**	**2/3,130,423**

1/ Includes: Carnelian, Chambourcin, French/American Hybrids, Muller Thurgau, Muscadine, and Vidal Blanc.
2/ Excludes unknown varieties.

Total production of Cabernet Sauvignon during 1990 was 597.3 tons, 15.2 percent of the total production. Yield averaged 1.09 tons per acre.

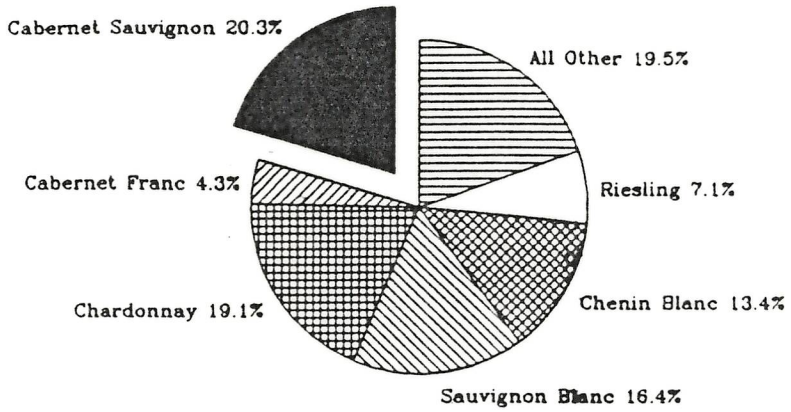
Barbera was a high yielding variety which averaged 2.44 tons per acre, but with only 89.3 acres in the state, production of 218.1 tons accounted for only 5.5 percent of the total.

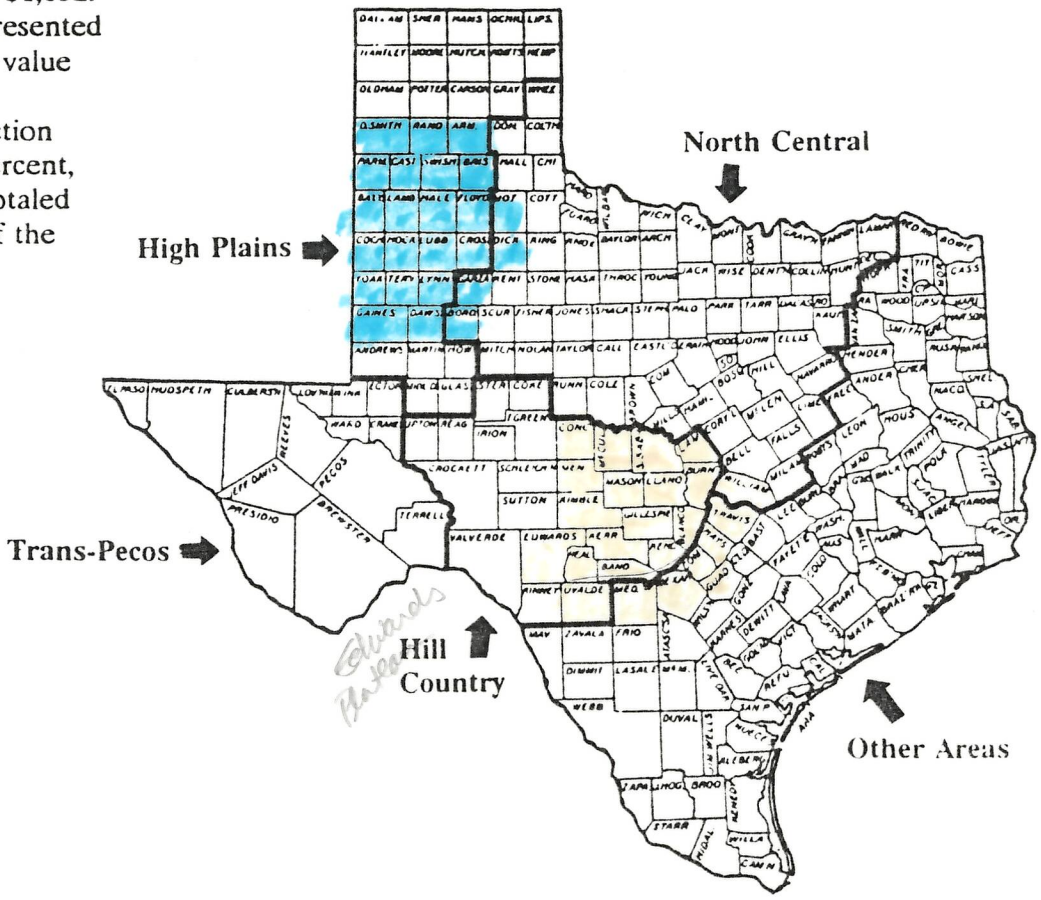
Leading Texas in value of production was Chardonnay with $717,303 or 22.9 percent of the state's total value. Average value per ton of Chardonnay grapes was $1,151.

Total value of Cabernet Sauvignon production during 1990 was $628,360 with an average value per ton of $1,052. Cabernet Sauvignon represented 20.1 percent of the total value of production

Chenin Blanc production totaled $560,623, 17.9 percent, while Sauvignon Blanc totaled $546,623, 17.5 percent of the 1990 total value.

Wine Grape Producing Acres by Variety Texas, 1990





Wine Grape Producing Acreage by Areas

The Texas High Plains leads the state in total wine grape producing acreage with 1,332 acres, 49.3 percent of the state total. The leading variety on the High Plains was Cabernet Sauvignon, and with 335.5 acres, the variety accounted for 25.2 percent of the total producing acreage in the region.

Producers on the High Plains have planted 308.1 acres in Chardonnay, 23.1 percent of the region's total producing acreage, while 156.9 acres of Sauvignon Blanc represented 11.8 percent of the total acreage.

Riesling acreage on the High Plains accounted for 10.3 percent, and Chenin Blanc, 9.1 percent.

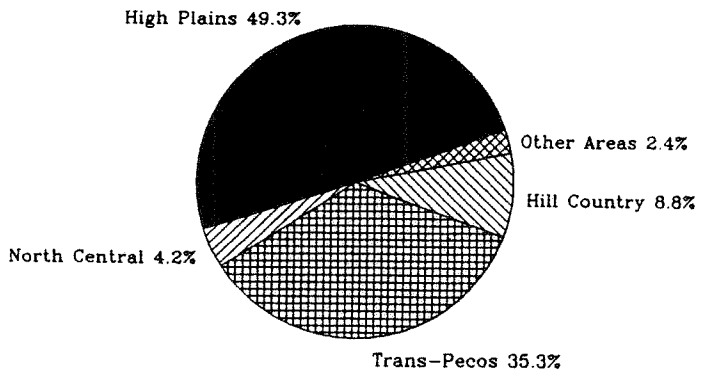
Growers in the Trans-Pecos have 952 acres of producing wine grapes, 35.3 percent of the total state acreage. Sauvignon Blanc was the leading variety in the Trans-Pecos with 249.0 acres, 26.2 percent of the region's total.

Chenin Blanc acreage represented 23.3 percent of the region's total producing acreage, while Chardonnay accounted for 13.7 percent.

The remaining areas were the Hill Country with 8.8 percent of the total Texas producing acres; North Central Texas, 4.2 percent; and "Other Areas" with 2.4 percent.

Cabernet Sauvignon was the leading variety in the Hill Country and North Central Texas, and the Barbera variety was only reported in the Trans-Pecos. The Lenoir variety was only found in the Hill Country and "Other Areas."

Wine Grape Producing Acres by Area Texas, 1990



Wine Grape Producing Acres by Area, 1990

Wine grape variety	High Plains	North Central	Trans-Pecos	Hill Country	Other Areas
			-- Acres --		
Barbera	0.0	0.0	89.3	0.0	0.0
Cabernet Franc	86.4	0.0	24.9	2.5	1.0
Cabernet Sauvignon	335.5	44.6	98.1	61.0	7.6
Chardonnay	308.1	17.0	130.6	54.1	5.8
Chenin Blanc	121.3	8.1	222.2	3.9	7.3
French Columbard	14.9	5.6	15.7	0.0	0.0
Gewurztraminer	25.5	0.0	6.2	2.0	0.0
Lenoir	0.0	0.0	0.0	15.0	22.2
Merlot	16.4	5.1	31.6	6.6	1.0
Muscat Canelli	12.6	0.0	14.6	0.5	2.5
Petite Siran	14.6	1.0	0.0	0.0	1.0
Pinot Noir	9.1	3.0	20.6	22.0	0.0
Riesling	137.1	13.7	13.9	24.0	2.0
Ruby Cabernet	18.3	0.5	20.5	0.5	4.0
Sauvignon Blanc	156.9	8.4	249.0	25.8	2.8
Semillon	22.9	1.5	0.0	5.0	0.3
Zinfandel	33.9	3.0	1.0	3.5	5.0
Other varieties 1/	5.0	2.5	1.8	10.6	2.5
Unknown varieties	13.5	0.0	12.0	0.0	0.0
TOTAL	**1,332.0**	**114.0**	**952.0**	**237.0**	**65.0**

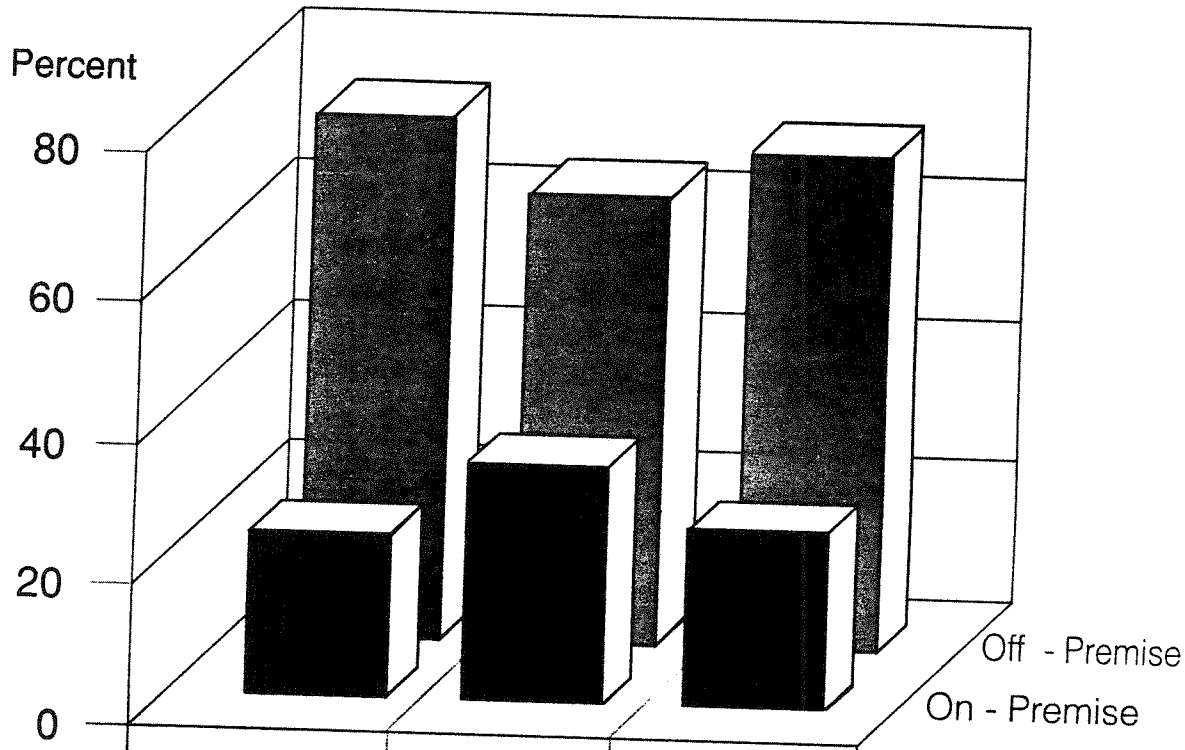
1/ Includes: Carnelian, Chambourcin, French/American Hybrids, Muller Thurgau, Muscadine, and Vidal Blanc.

Location of Wine Consumption

Of all wine, beer, and spirits consumed, the majority (70.8 percent) is consumed off-premise either in a person's home or while visiting another person's home. Figure 4 compares consumption of alcoholic beverages by the location of consumption of the three alcohol groups. Wine has the largest percentage of consumption off-premise with 76.5 percent consumed at home. Nearly 66 percent of wine is consumed in a person's home while 10.5 percent is consumed in another person's home.

Spirits have the largest proportion sold on-premise (bars, restaurants, sporting events, and at the office) with 36.6 percent of all spirit consumption. Beer and other malt beverages has 29.3 percent of consumption on-premise and 70.7 percent at home.

Alcohol Beverage Consumption by Location of Consumption, U.S. (%of Volume)
(Figure 4)



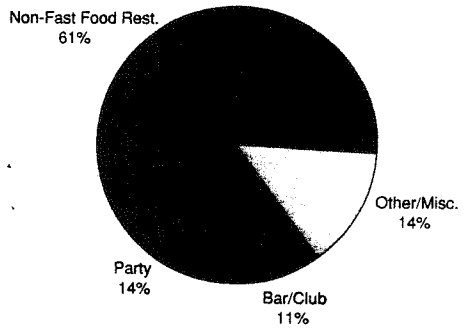
	Wine	Spirits	Beer
Off-Premise	76.5	63.4	70.7
On-Premise	23.5	36.6	29.3

Source: TX Wine Marketiing Research Inst., 1991 and Impact Inc ., 1990

Wine consumption away from home (on-premise) is mainly in non-fast food restaurants (61 percent) followed by parties, and then in bars and clubs (Figure 5). The remainder of wine consumption on-premise is at sporting events, office and work situations, and at fast food restaurants.

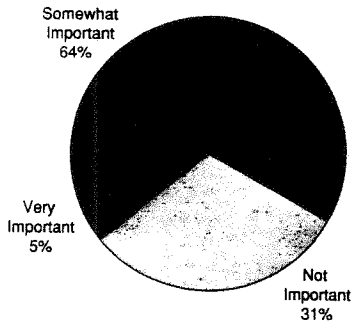
When a wine consumer orders wine in a restaurant, the servers suggestions are either very important or somewhat important 69 percent of the time. (Figure 6). The servers suggestions are not considered important about 31 percent of the time.

Away From Home Wine Consumption by Location (% of Volume), U.S., 1990 (Figure 5)



Source: TX Wine Marketing Research Inst., Texas Tech University, 1990

When Ordering Wine in a Restaurant in Texas, How Important are Server Suggestions in Making Your Selection? (Figure 6)



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(2)

Texas HighwayDepartment Poster located at the rest stops over the High Plains Area. These posters are four feet by four feetin size.

THE TEXAS HIGH PLAINS

Traveling on the Texas High Plains: an experience in immensity! This southernmost extension of the continent's Great Plains was called the Llano Estacado (staked plains) by Spanish conquistadors. A branch of the Great Comanche War Trail swept across the expanse, and herds of buffalo—numbering in the millions—roamed at will.

When pioneer settlers first arrived, all was grassland—not a single tree or shrub. Juniper and cottonwood trees grew in isolated canyons, but on the vast surface, nothing but grass—stirrup-deep for thousands of square miles—as trackless as the sea.

The plains' first settlers were ranchers with holdings of empire size. Largest was the XIT that spread across three million acres—more than 4,700 *square miles* of rangeland! Charlie Goodnight, pioneer rancher and trail drover, invented the chuck wagon here to serve cowboys over these vast distances.

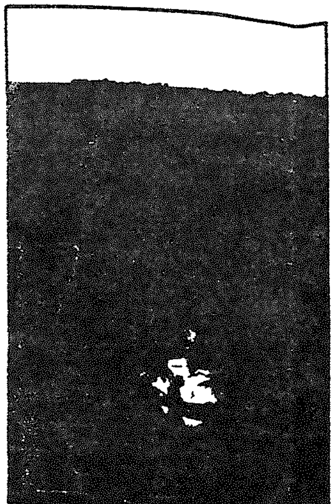
Today, most of the plains are intensively cultivated farmlands whose rows stretch from horizon to horizon. Crops thrive in brilliant sunshine. And though rainfall averages only 16 to 20 inches a year, thousands of wells draw irrigation water from the giant Ogallala aquifer that underlies the whole region.

During harvest season, rail cars from throughout the nation haul virtual mountains of wheat, milo maize, soybeans, and cotton. Much of the grain and fiber bonanza funnels through Texas ports to international markets.

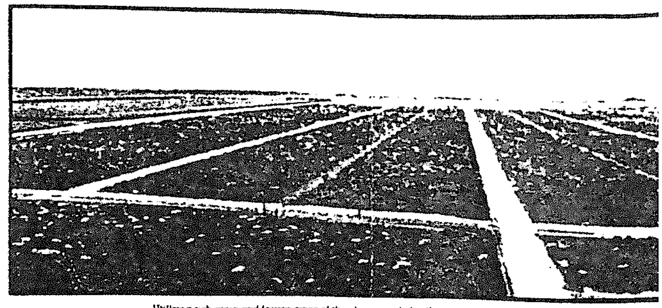
The land offers other abundance. Thousands of feet deep, far below the Ogallala aquifer, drillers have tapped enormous reservoirs of oil and natural gas. Nodding pump jacks draw the precious energy resources to the surface. Mingled with natural gas from the Panhandle-Hugoton gas field near Amarillo is the free world's richest source of the rare natural element, helium.

Livestock feedlots are major modern enterprises on the Texas High Plains. As range livestock near market age and weight, the animals are gathered for intensive 90- to 120-day feeding programs. With computer-controlled feed formulas, the animals are "finished off" to precise weight and grade requirements of meat packers.

Travelers on the Texas High Plains can be sure of one constant: The land is nearly table-flat except where disturbed by erosion. And therein lies the geographical drama of the plains, where erosion has carved spectacular landscapes: Palo Duro Canyon, location of Texas' largest state park; the rugged Canadian River breaks, and many colorful, abrupt edges where the plains end (known as the edge of the Caprock) at scenic sites like those east of the Panhandle towns of Silverton, Quitaque, and south of Post.



A High Plains "oil field." Giant sunflowers, the plains' most colorful crop, produce seeds yielding an easily digestible, low-cholesterol cooking oil that sustains its properties even at high heat.



Utilizing rich grain and forage crops of the plains, cattle feedlots are major agribusiness enterprises. Range livestock are gathered for 90- to 120-day concentrated feeding programs, being "finished off" to precise weight and grade requirements of meat packers.

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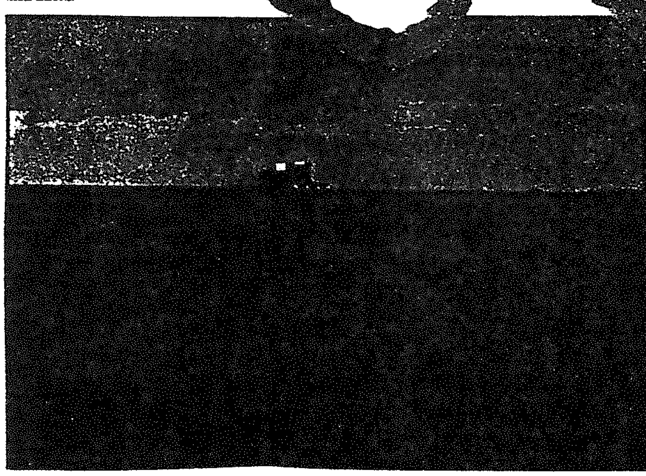
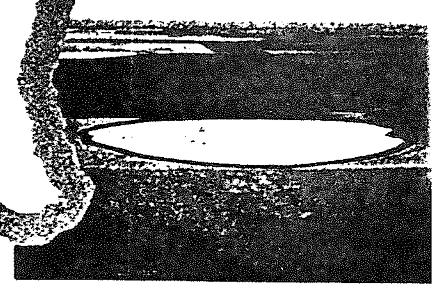
Huge combines may appear as miniature toys in the vastness of the High Plains. Much of the plains' wheat (pictured here) and other small grains funnel through Texas ports to international markets.



On the table-flat High Plains where nat
drainage systems haven't developed, the
simply no place for rainwater to go. Rain
that doesn't soak in collects in shallow oval
depressions called playas. It soaks into the
ground, or evaporates during dry periods.

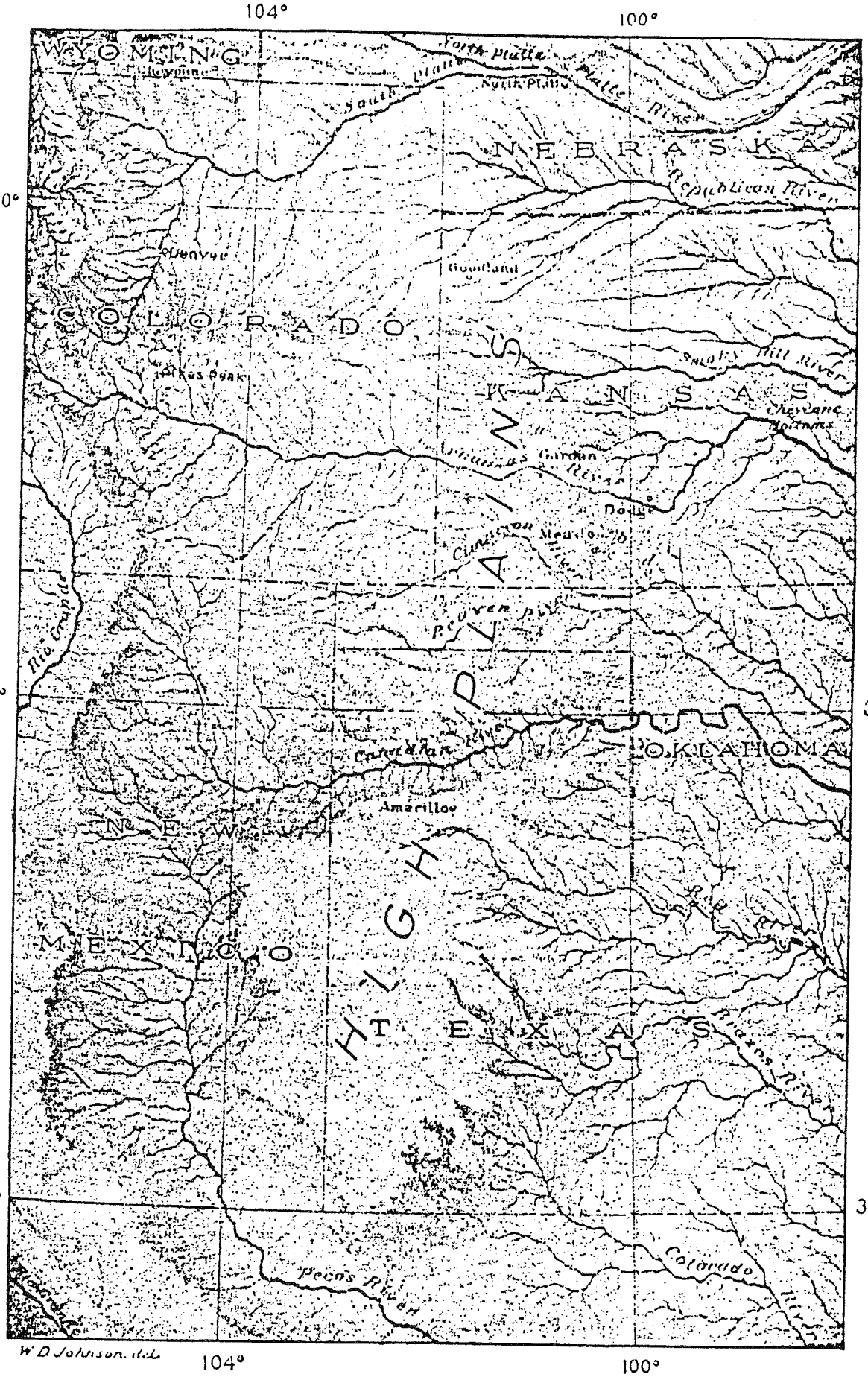


(3)

Walter Prescott Webb

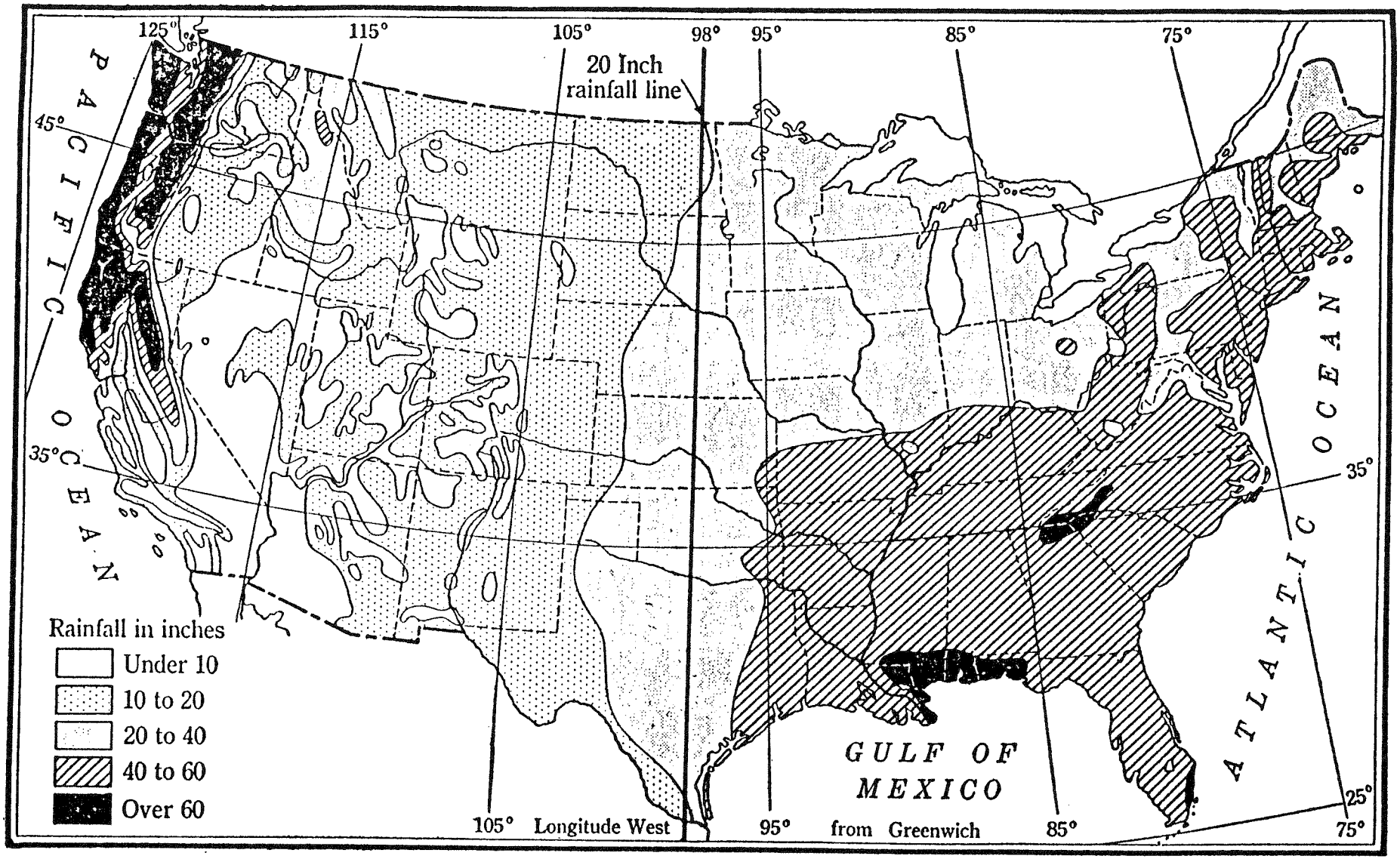
THE GREAT PLAINS

University of Nebraska Press
Lincoln and London



The High Plains

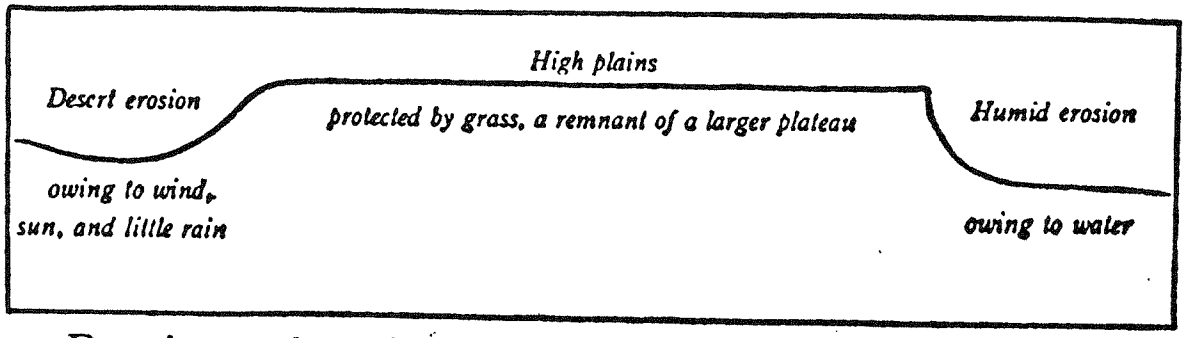
THE GREAT PLAINS, Walter Prescott Webb, University of Nebraska Press 1931,1959. pp 15..



Approximate average annual precipitation

THE GREAT PLAINS, Walter Prescott Webb, Univ. of Nebraska Press, 1931-1959 pp.18..

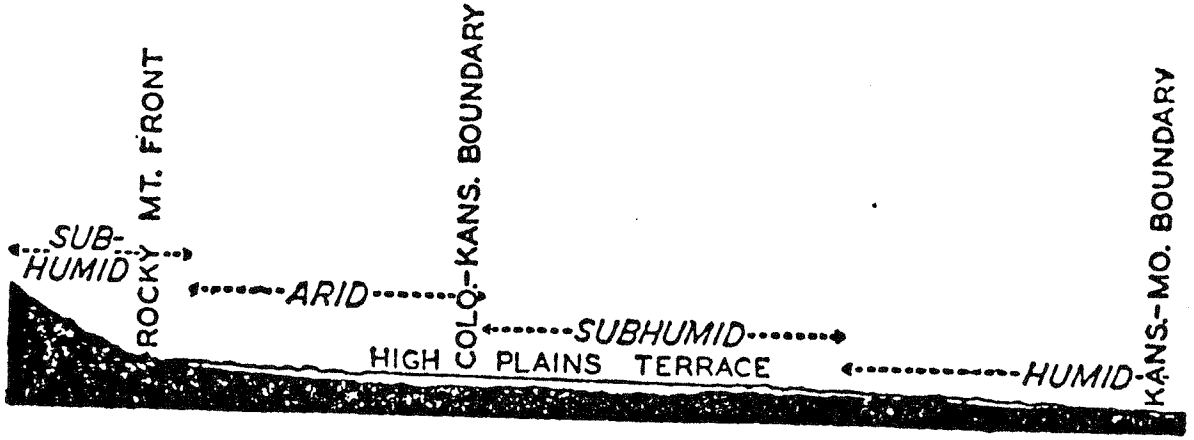
(3)



Drawing to show the High Plains as a survival, or remnant

from page 329

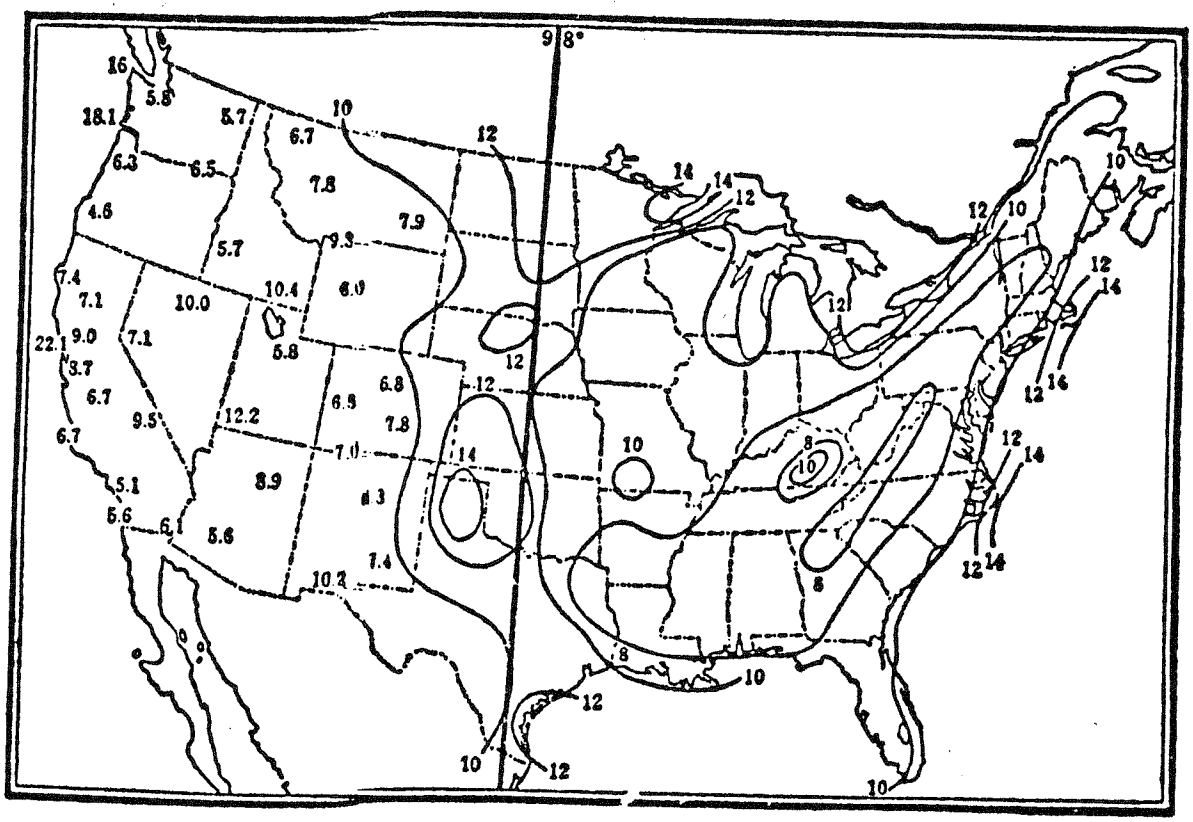
THE GREAT PLAINS, Walter prescott webb, University of Nebraska Press 1931-1959.



Profile of the Great Plains

United States Geological Survey

from page 14



Average hourly wind velocity

The figures indicate the velocity estimated for the uniform elevation of a hundred feet. (United States Department of Agriculture)

Texas Department of Agriculture
Marketing Division
P. O. Box 12847
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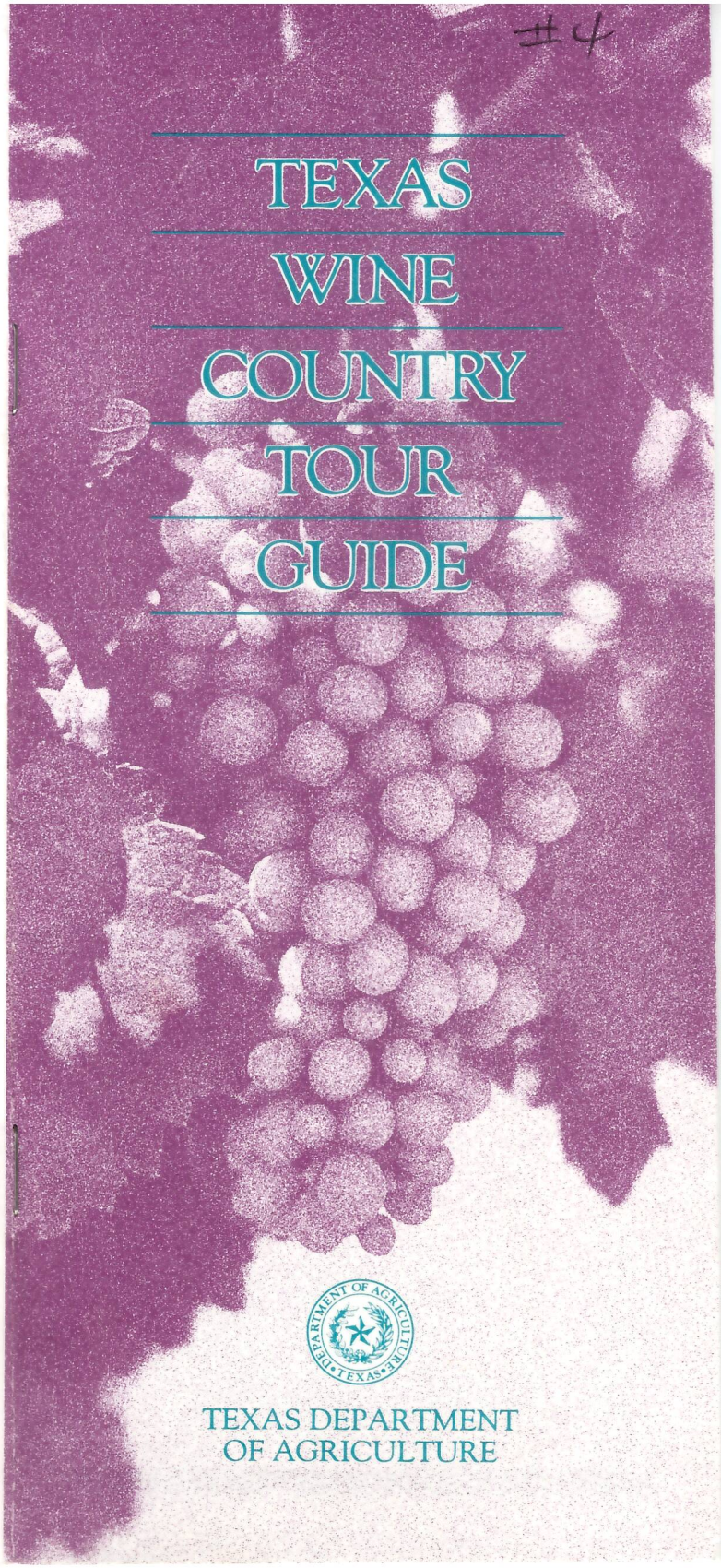
#4

TEXAS WINE COUNTRY TOUR GUIDE

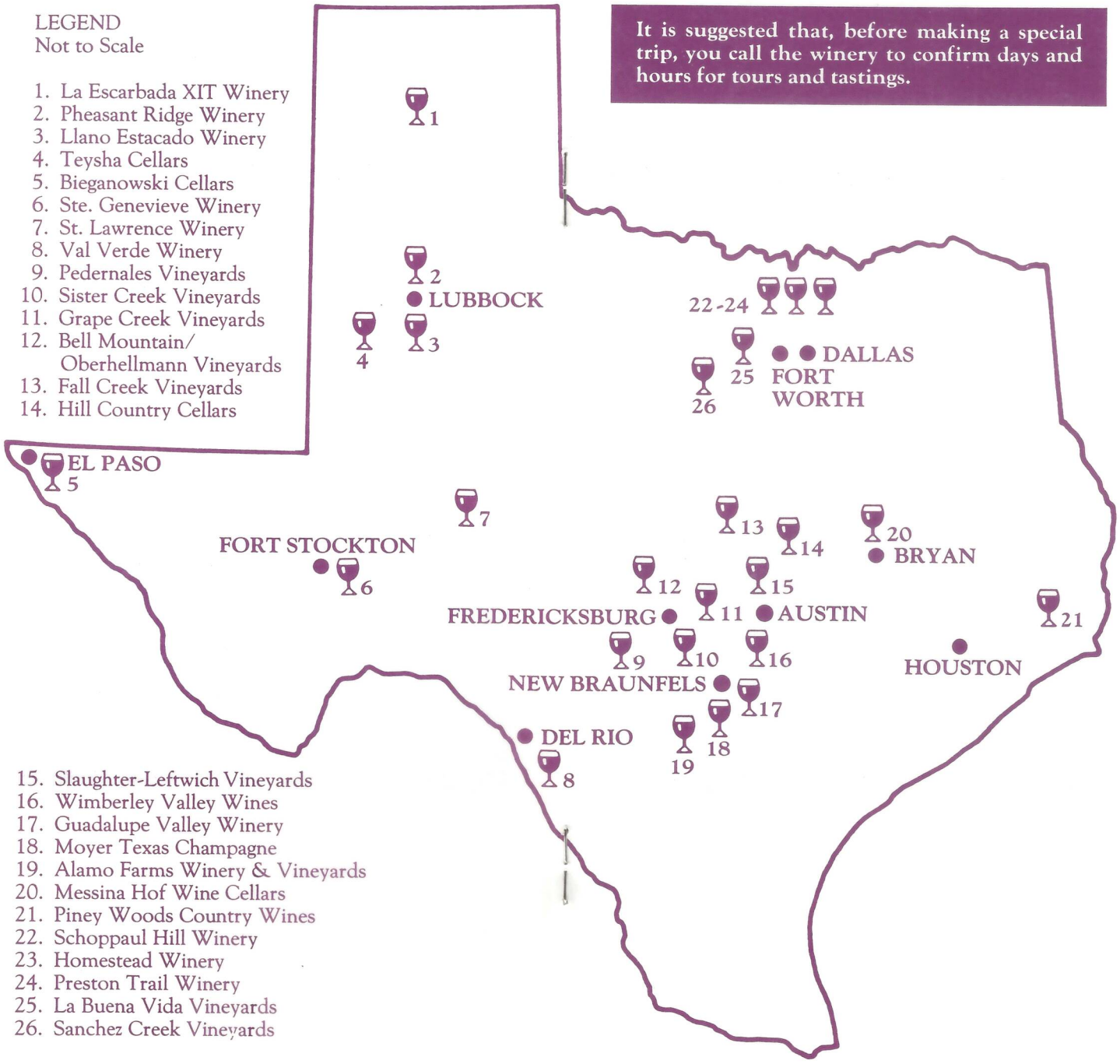


TEXAS DEPARTMENT
OF AGRICULTURE

LEGEND
Not to Scale

1. La Escarbada XIT Winery
2. Pheasant Ridge Winery
3. Llano Estacado Winery
4. Teysha Cellars
5. Bieganowski Cellars
6. Ste. Genevieve Winery
7. St. Lawrence Winery
8. Val Verde Winery
9. Pedernales Vineyards
10. Sister Creek Vineyards
11. Grape Creek Vineyards
12. Bell Mountain/ Oberhellmann Vineyards
13. Fall Creek Vineyards
14. Hill Country Cellars

It is suggested that, before making a special trip, you call the winery to confirm days and hours for tours and tastings.



15. Slaughter-Leftwich Vineyards
16. Wimberley Valley Wines
17. Guadalupe Valley Winery
18. Moyer Texas Champagne
19. Alamo Farms Winery & Vineyards
20. Messina Hof Wine Cellars
21. Piney Woods Country Wines
22. Schoppaul Hill Winery
23. Homestead Winery
24. Preston Trail Winery
25. La Buena Vida Vineyards
26. Sanchez Creek Vineyards

texas tech news

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(5)

LUBBOCK, Texas -- Texas Tech University Geography Department Chairman William B. Conroy has a special message for a Voice of America (VOA) listener in Yugoslavia.

It is that the Llano Estacado is alive, and well, and furthermore prospering.

The story began when Dr. Conroy received a telephone call from Kim Baker, VOA employe associated with a program which answers questions sent in by listeners from foreign countries.

The listener from Yugoslavia had written that he had always understood that the Llano Estacado was a barren desert devoid of inhabitants. He said that he recently looked at a map of this general area and was surprised to see that there were towns with names like Lubbock and Muleshoe located on the Llano Estacado.

"How," the listener wondered, "did the people in these places make a living in such a desolate region?"

Prof. Conroy has prepared material for an answer which will be broadcast on VOA to Yugoslavia Sunday, Dec. 10. The answer is based on this bit of enlightenment by the Texas Tech geography professor:

"The Llano Estacado is a high, flat, semi-arid tableland of over 20,000 square miles that straddles the border of western Texas and eastern New Mexico. The surface of the Llano Estacado was originally carpeted by a thick turf of buffalo and grama grass and was devoid of terrain features of any kind, except for the numerous playa lakes that pockmark its surface.

"The origin and original meaning of the Spanish name Llano Estacado (Staked Plain) is uncertain. Theories as to the rationale for this name include the following.

"1. The name originated from the practice of marking trails across the featureless plain with buffalo chips, bones, or stakes driven into the ground.

"2. The name originated from the necessity of tethering horses to stakes on the Llano Estacado when travelers stopped to camp at night.

"3. Llano Estacado is a New Mexican corruption of 'Llano Destacado,' the frontier meaning of which was 'elevated plain.'

"4. The Llano Estacado was so called because of the rampartlike or pallisaded appearance of its northwestern escarpment.

"The Llano Estacado was indeed considered to be a barren wasteland by travelers who saw it, until the last two decades of the Nineteenth Century. It was at this time that the first ranchers and then farmers began to tap the great underground water reserves of the region.

"Today the Llano Estacado is a highly prosperous agricultural region specializing in the production of cattle, wheat, cotton and grain sorghum. In the southern part of the Llano Estacado in the region around Lubbock there is a great amount of farming of cotton and grain sorghum under irrigation, the water coming from deep wells that tap the underlying Ogallala Aquifer."

Prof. Conroy's answer for the Yugoslavian listener may not be news to most residents of this area; but it contains a bit of history and conjecture which could likely be informative -- even for some who have grown up on the Llano Estacado and nearly everybody east of the Mississippi.

-30-

6-12-5-72

By Dan Tarpley

THE LLANO ESTACADO IN 1541:
Spanish Perception of a Distinctive Physical Setting

By William B. Conroy

ALMOST EVERYONE in the United States of America has heard of or been exposed to the stories of two great land explorations by Spaniards, one in the Southwest led by Francisco Vásquez de Coronado, and the other in the Southeast commanded by Hernando de Soto. Both occurred at about the same time (the years 1539-1543) and they nearly encountered each other during their wanderings eastward and westward. Although they originated in different locales – de Soto in Cuba and Florida, Vásquez de Coronado in New Spain and particularly in the province of Sinaloa – and their forces differed in total numbers, each had the same fundamental goals to locate mythical Indian civilizations and to obtain great wealth for their participants as well as their sponsors. With these objectives solely in mind, both expeditions may be judged as failures, and for this reason Anglo-Americans have tended to evaluate all Spanish exploratory and colonizing ventures as purely transitory, having no lasting impact upon the history of the United States.

However, the de Soto and Vásquez de Coronado expeditions had many side effects, contributing markedly to the knowledge and development of the Spanish Borderlands. Taking the Vásquez de Coronado expedition as an appropriate example, we may note that it familiarized Spanish officials with the climate and nature of the terrain far north of Mexico City at a very early period in the expansion and consolidation of the Spanish kingdoms in America. Such exploration brought forth the first European observations of the Río Grande Valley in New Mexico, the Great Plains of Kansas and West Texas, and the *Llano Estacado* (Staked Plain) of Eastern New Mexico and Western Texas, so capably portrayed in this reading by William B. Conroy. Second, the expedition brought Spaniards into contact for the first time with the native civilizations of the Great Basin, Sonoran Desert, Río Grande Valley, and Great Plains. Knowledge of these Indians, particularly of the advanced, sedentary Pueblo of New Mexico and their culture, established a future goal for the religious conversion and Europeanization of these people in later times when missionaries, soldiers, and settlers reached this frontier. Third, the results of the Vásquez de Coronado expedition revealed that there were no civilizations in the Far North that resembled "another Mexico," thereby bringing to an end Spain's first burst of widespread exploration. In the half-century that followed Spanish officials concentrated upon the consolidation of government in New Spain, exploitation and settlement of regions where they discovered great silver deposits on the Central Plateau, and a more gradual frontier expansion into Nueva Vizcaya, Sinaloa, and Sonora.

This reading originally appeared in JOURNAL *of the* WEST, in October, 1972.

THE LLANO ESTACADO, a distinctive and unique landform of the Great Plains of the United States, lies astride the border of New Mexico and Texas (see map). The settlement of the Llano Estacado and its development into a prosperous farming area have occurred mainly in the twentieth century. For most of the nineteenth century, Anglo-Americans perceived this high, flat tableland as an area devoid of agricultural potential due to its lack of water, and one difficult, even dangerous, just to cross. Yet, the Llano Estacado was one of the first parts of Anglo-America to be traversed and described by Euro-

peans. The expedition of Francisco Vázquez de Coronado passed over this landform in the late spring of 1541, less than fifty years after the first voyage of Columbus.

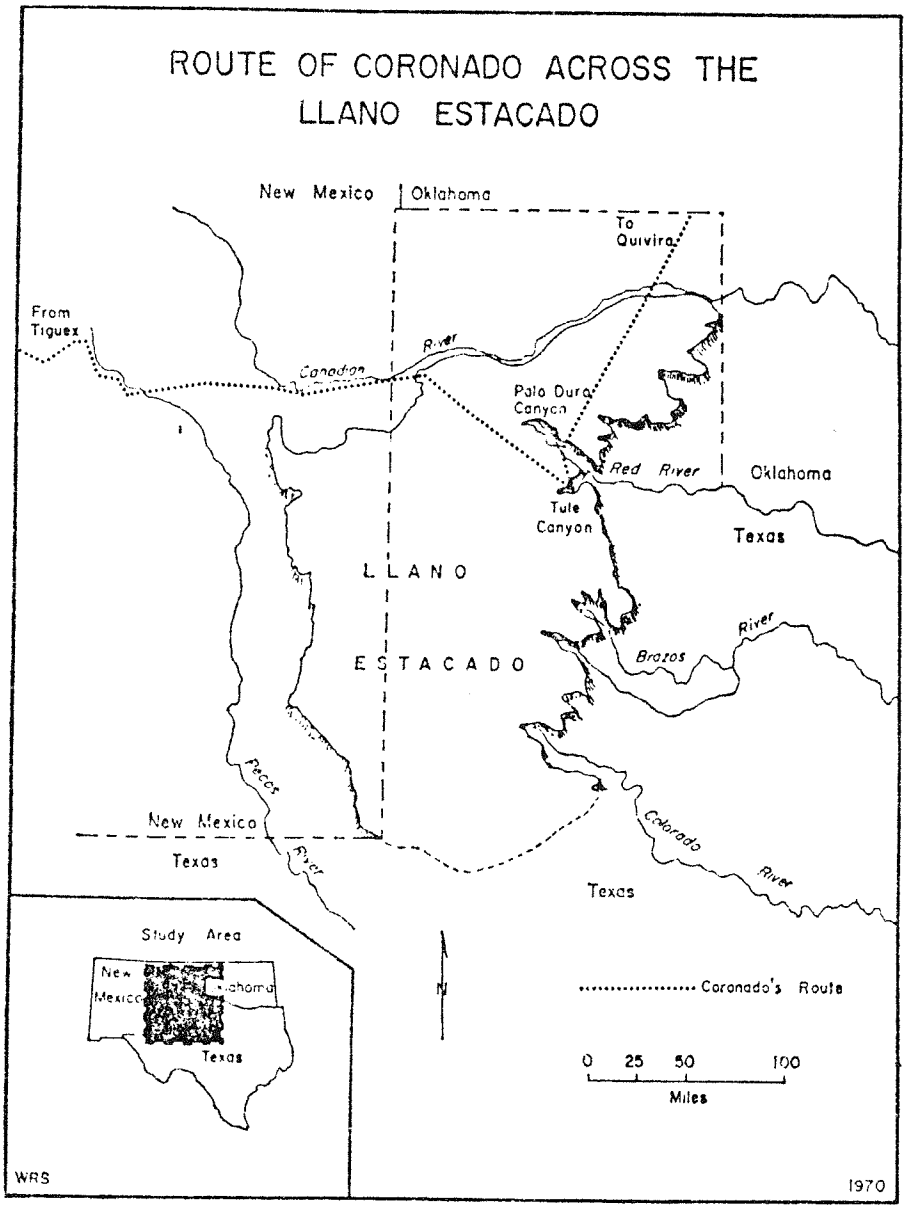
The Llano Estacado

With its 20,000 square miles of flat surface, its wild vegitation of short grass, and its mean annual rainfall of less than twenty inches, the Llano Estacado, or Staked Plain, is an example in purest form of the "plains environment" described by Walter Prescott Webb in his classic, The Great Plains.[1] Like other parts of the High Plains, the Llano Estacado was built up by the deposition of material eroded from the Rocky Mountains by eastward flowing streams in Tertiary times.[2] Subsequent erosion of this fluvial matter by the Canadian River on the north, the Pecos River on the west, and the Red, Brazos, and Colorado River systems on the east isolated the Llano Estacado portion of the High Plains, leaving its flat, generally uneroded surface in higher relief than the lands around it. Only in the south, where it merges imperceptibly with the Edwards Plateau, and along portions of its western perimeter, is the boundary of the Llano Estacado not well defined. The eastern edge of the Staked Plain and parts of its western edge are marked by an escarpment of "caprock," which consists of a layer of erosion resistant caliche, with a local relief varying from less than one hundred to more than one thousand feet. Palo Duro Canyon, the largest of the canyons cut into the eastern caprock by stream erosion, has a relief from rim to floor of 1,200 feet.

The 20,000-square-mile surface of the Staked Plain is one of the flattest areas in the United States, although it does slope gradually downward from elevations exceeding 4,000 feet in the northwest to somewhat less than 3,000 feet in the southeast. Today, its horizon is dotted by windmills, grain elevators, and buildings of farms and settlements. However, one century ago, the Llano Estacado, covered by a thick turf of short grama and buffalo grass, was virtually devoid of features of any kind except for the thousands of shallow depressions, varying in diameter from a few feet to more than one mile, which pockmark its surface. Many playa lakes are formed by the drainage of rainwater into these depressions.[3] During dry periods, these lakes shrink in size and many disappear.

For almost all of the Llano Estacado, there is no permanent surface water supply. The streams found close to its borders are intermittent and the few springs tend to be located in canyons and ravines at the edges of the caprock rather than on the Llano Estacado itself. Today, water for irrigation farming of cotton and grain sorghum comes from deep wells which tap the underlying Ogallala Aquifer.

The origin of the name Llano Estacado is uncertain. It is not mentioned in the narratives of the Coronado expedition. It apparently originated later among the Spanish in New Mexico. Early Anglo-Ameri-



—Map by the Author

cans translated Llano Estacado as "Staked Plain." Theories as to the rationale for this name include the following: (a) the name originated from the practice of marking trails across the featureless plain with buffalo chips, bones, or stakes driven into the ground; (b) the name originated from the necessity of tethering horses to stakes on the Llano Estacado when travelers stopped to camp at night: (c) Llano Estacado is a New Mexican corruption of "Llano Destacado," the frontier meaning of which was "elevated plain," (d) the Llano Estacado was so called

because of the rampart-like or pallisaded appearance of its northwestern escarpment.[4]

The weather of the Llano Estacado is variable, due largely to the frequent movement of cold fronts, or "northers," southeastward across the landscape. Associated with the passage of weather fronts, especially in the spring, the season the Coronado expedition passed through this area, are a substantial number of large, severe thunderstorms with high winds and hail. Frequently, tornadoes, too, are spawned by these towering cumulonimbus clouds.

The Coronado Expedition

In February, 1540, the youthful Francisco Vázquez de Coronado was dispatched northward from Compostela, Mexico, by the viceroy of New Spain with an expedition to search for the Seven Cities of Cíbola and the riches they reputedly contained. The "Seven Golden Cities" which the Spanish found were a group of Zuñi Indian pueblos located near the present Arizona-New Mexico boundary, and they contained no treasure. Undaunted, Coronado dispatched several small exploration parties from Cíbola, and one of these discovered the "province of Tiguex," the fertile upper Río Grande Valley with its numerous pueblos. The same reconnaissance party which discovered Tiguex learned from a captive Indian of a wondrous land called Quivira, containing great amounts of gold and silver, which lay somewhere to the east on the vast plains beyond the mountains. The stories of this Indian excited Coronado and in the spring of 1541, with the native as a guide, he and his army crossed the Río Grande, passed eastward through the mountains by a route later followed by the Santa Fe Trail, and reached the Great Plains. The narratives, written by members of the expedition, including that of Coronado himself and the lengthy account of Pedro de Castañeda, are relatively explicit as to the route the Spanish followed across the Great Plains and what they saw there. Direction was noted by compass and distance was recorded by a member of the expedition who was detailed to count his footsteps each day.[5] The landscape over which the Spanish passed and the forms of life they encountered, including the buffalo and the Plains Indian, were described with accuracy and in detail.

Crossing the Pecos River, the army marched northeastward through the shallow valley cut into the High Plains by the Canadian River. From this valley their treacherous captive Indian guide led them southeastward up onto the Llano Estacado, over which they traveled for several days. The members of the Spanish expedition were impresssed by the flatness of the surface of the Llano Estacado. Coronado himself stated that it was

> . . . as bare of landmarks as if we were surrounded by the sea. Here the guides lost their bearings because there is nowhere a stone, hill, tree, bush, or anything of the sort.[6]

Castañeda noted:

> . . . many of the men who went hunting got lost and were unable to return to the camp for two or three days. They wandered from place to place without knowing how to find their way back. . . . It must be remarked that since the land is so level, when they had wandered aimlessly until noon, following the game, they had to remain by their kill, without straying, until the sun began to go down in order to learn which direction they then had to take to get back to their starting point.[7]

Apparently, only a few of the Spaniards possessed compasses. The Teyas Apaches, who guided the main army on its return across the Llano Estacado, employed a unique method of maintaining a constant direction:

> Their method of guiding was as follows: early in the morning they watched where the sun rose, then, going in the direction they wanted to take they shot an arrow, and before coming to it they shot another over it, and in this manner they traveled the day. . . .[8]

The presence of the playa lakes which dot the otherwise featureless landscape of the Llano Estacado and other portions of the Great Plains was noted with the comment:

> . . . there were found some ponds, round like plates, a stone's throw wide or larger. Some contained fresh water, others salt.[9]

The short grass that carpeted the Llano Estacado impressed Coronado as providing "many excellent pastures."[10] Castañeda recorded that the grass tended to spring upright after the expedition passed over it, leaving no trace of the passage. Because of this,

> . . . it became necessary to stack up piles of bones and dung of the cattle at various distances in order that the rear guard could follow the army and not get lost.[11]

The Spanish experienced some of the violent weather so characteristic of the Llano Estacado while camped in Tule Canyon along its eastern escarpment.

> While the army was resting in this ravine we have mentioned, a violent whirlwind arose one afternoon. It began to hail, and in a short time such an amount of hailstones fell, as large as bowls and even larger, and as thick as rain drops, that in places they covered the ground to a depth of two and three and even more spans. . . . The hailstones destroyed many tents and dented many headpieces. Many horses were bruised, and all the pottery and gourds of the army were broken.[12]

The most noteworthy animal life which the Coronado expedition found on the Llano Estacado as well as on all of the Great Plains over which it journeyed were the vast herds of American bison, which the Spanish simply called cattle. Castañeda described this animal in somewhat terrifying terms:

> Their eyes bulge on the sides, so that, when they run, they can see those who follow them. They are bearded like very large he-goats. When they run they carry their heads low, their beards touching the ground. From the middle of the body back they are covered with very woolly hair

> like that of fine sheep. From the belly to the front they have very heavy hair like the mane of a wild lion. They have a hump larger than that of a camel. Their horns, which show a little through the hair, are short and heavy. . . . They have short tails with a small bunch of hair at the end. When they run they carry their tails erect like the scorpion.[13]

Coronado remarked on the fierceness of the buffalo, who killed some of the horses during hunting forays. He also was impressed by their great numbers:

> On them [the Great Plains] I found so many cattle, . . . that it would be impossible to estimate their number. For in traveling over the plains, there was not a single day, until my return, that I lost sight of them.[14]

It was the meat of the bison, roasted over fires of buffalo chips, that supplied the Spanish with food when their own supplies were exhausted.

Along with the great buffalo herds, the Spanish encountered many of the pre-horse culture Plains Indians who subsisted from them. In the Canadian River Valley along the northern border of the Llano Estacado, the Spanish met natives whom the Pueblo Indians called Querechos. Along the eastern escarpment of the Staked Plain they met another group called Teyas. It has been concluded that both of these groups were Apache Indians.[15]

The great dependence of the Plains Indians on the buffalo was described by Coronado:

> They do not cultivate the land, but eat raw meat and drink the blood of the cattle they kill. They dress in the skins of the cattle, with which all the people in this land clothe themselves, and they have very well-constructed tents, made with tanned and greased cowhides, in which they live and which they take along as they follow the cattle. They have dogs which they load to carry their tents, poles, and belongings.[16]

Castañeda commented on how the Indians preserved buffalo meat: "They dry their meat in the sun, slicing it in thin sheets. When it is dry they grind it, like flour, for storage and for making mash to eat."[17] A third member of the expedition described how many parts of the buffalo were utilized by the Plains Indian:

> These Indans live or sustain themselves entirely from the cattle, for they neither grow nor harvest maize. With the skins they build their houses: with the skins they clothe and shoe themselves; from the skins they make ropes and also obtain wool. With the sinews they make thread, with which they sew their clothes and also their tents. From the bones they shape awls. The dung they use for firewood, since there is no other fuel in that land. The bladders they use as jugs and drinking containers. They sustain themselves on their meat, eating it slightly roasted and heated over the dung. Some they eat raw. . . . They drink the blood just as it comes out of the cattle. Sometimes they drink it later, raw and cold.[18]

Other forms of wild animal life noted by the Spanish as being present on the plains included "animals resembling squirrels" (prairie

dogs), hares, white wolves, deer (possibly antelope), and chickens (prairie chickens).

The Spanish discovered, as had the Indians, that the canyons which had been eroded into the eastern escarpment of the Llano Estacado offered a number of advantages over the plains themselves as campsites. It was in Palo Duro Canyon, the largest of these, that the expedition camped to rest, to replenish its food supply by hunting buffalo, and to decide on the next course of action.[19] In the canyon were wood and fresh water, and its steep-sided walls formed a natural corral for the livestock. Castañeda commented that the canyon

> . . . extended a league from bank to bank. A small river flowed at the bottom, and there was a small valley covered with trees, and with plenty of grapes, mulberries, and rose bushes. . . . There were nuts, and also chickens . . . and quantities of plums like those of Castile.[20]

It was from this canyon that Coronado set out northward with thirty horsemen in search of Quivira and from which the rest of the expedition traveled westward across the Llano Estacado on their return to the Río Grande Valley. It was also in this canyon more than three centuries later that the Comanche Indians suffered their final, decisive defeat at the hands of the U. S. Cavalry, and where, shortly thereafter, Charles Goodnight established the first cattle ranch in the Texas Panhandle.

Subsequent History of the Llano Estacado

The Spanish description of the Llano Estacado and the life on it was remarkably accurate as was their assessment of the entire plains area as grazing country. However, Coronado was not looking for grazing land, but for gold and silver. He had invested 50,000 ducats in the expedition in hopes of finding riches and his viceroy had invested even a greater sum.[21] When he returned to Mexico after his remarkable reconnaissance of the Southwest without finding treasure, his failure discouraged the immediate launching of any further expeditions into New Mexico and Texas. More than fifty years passed before colonization in the upper Río Grande Valley and missionary activity among the Pueblo Indians there were begun. As for the Llano Estacado, it was too remote and unappealing for settlement by the Spanish although later expeditions passed near and occasionally over it. The Staked Plain was destined to become part of the domain of the Comanche Indians, who by the eighteenth century had pushed southward into Texas and had acquired the horse.[22] The Staked Plain remained a part of Comanchería until 1875, when with most of their horses and many of the buffalo destroyed, the last major band of starving Comanches under Quanah Parker surrendered at Fort Sill and reëntered their reservation in Oklahoma.[23] During the years of Comanche dominion, New Mexican traders, the Comancheros, regularly crossed the Llano Estacado to its eastern edge to barter firearms, ammunition, knives, liquor, cloth, beads, bread, and

other items for horses and cattle which the Indians had stolen from settlements in Texas and Mexico, and from drovers.[24]

Early Anglo-American Perception of the Staked Plain

Until well after the Civil War, the Anglo-American regarded the Llano Estacado, a part of the "Great American Desert," as a region to be approached cautiously and avoided if possible. He crossed it only when absolutely necessary and when he had done so, he left it behind him with a feeling of great relief. His main fear was of not being able to find fresh water, and a related concern was of becoming lost on the featureless landscape. Josiah Gregg, in describing a trip through the Canadian River Valley in 1839, spoke of a Mexican in his party who wanted to lead them southward ". . . into the fearful Llano Estacado, . . . we would probably have perished."[25] The Englishman Thomas Falconer, who accompanied the ill-fated Texas Santa Fe Expedition in 1841, mentioned the reputation of the Llano Estacado as being "too extensive to travel over, . . . without water, and where many of our horses would perish."[26] In 1849, Captain Randolph B. Marcy passed over the northern edge of the Llano Estacado while escorting a wagon train from Fort Smith, Arkansas, to Santa Fe. He described the Staked Plain as

> . . . a vast illimitable expanse of desert prairie . . . the great Zahara of North America . . . a land where no man, either savage or civilized, permanently abides; . . . a treeless, desolate waste of uninhabitable solitude, which always has been, and must continue uninhabited forever. . . .[27]

In 1854, Captain John Pope, under orders to explore and survey a possible railroad route between the Río Grande and the Red River, cautiously kept his main command to the south of the Llano Estacado. Pope sent only scouting parties to reconnoiter that portion of the route which passed over the Staked Plain's southern margins. When these parties returned, Pope noted: "The surveying of this dreadful Llano is now accomplished; its reputed horrors, by no means exaggerated, have been overcome. . . ."[28]

In 1866, when Goodnight and Loving blazed their cattle trail from Texas to New Mexico, they followed a circuitous route to avoid the Comanches and also the Mescalero Apaches, who occupied the southwestern escarpment of the Llano Estacado and became a constant menace to drovers and their herds on this trail.

It was not until the last quarter of the nineteenth century, more than three hundred years after the expedition of Coronado, that the first Anglo-American ranchers arrived to begin the settlement and development of the now agriculturally prosperous Staked Plain.

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2. This description of the physical characteristics of the Llano Estacado is based largely upon

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3. Theories as to the origin of these depressions are discussed in Thornbury, *op. cit.*, pp. 304-306.
4. Walter Prescott Webb and H. Bailey Carroll, eds., THE HANDBOOK OF TEXAS, Vol. II (Austin: Texas State Historical Association, 1952), pp. 69-70.
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6. *Ibid.*, p. 186.
7. *Ibid.*, p. 241.
8. *Ibid.*, p. 242.
9. *Ibid.*, p. 261.
10. *Ibid.*, p. 186.
11. *Ibid.*, p. 279.
12. *Ibid.*, p. 238.
13. *Ibid.*, p. 279.
14. *Ibid.*, p. 186.
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16. *Narratives of the Coronado Expedition*, p. 186.
17. *Ibid.* p. 262
18. *Ibid.*, pp. 310-311.
19. Herbert E. Bolton, CORONADO: *Knight of the Pueblos and Plains* (Albuquerque: The University of New Mexico Press, 1949), pp. 253-269, 427-428.
20. *Narratives of the Coronado Expedition*, p. 239.
21. Herbert E. Bolton, *op. cit.*, p. 53.
22. It is generally believed today that the Plains Indians acquired the horse from seventeenth century Spanish settlements in New Mexico rather than from strays of the Coronado or De Soto expeditions. See W. W. Newcomb, *op. cit.*, pp. 86-88.
23. Ernest Wallace and E. A. Hoebel, THE COMANCHES: *Lords of the South Plains* (Norman: University of Oklahoma Press, 1952), pp. 285-329.
24. J. Evetts Haley, "The Comanchero Trade," *Southwest Historical Quarterly*, Vol. XXXVIII (1934-35), pp. 157-176.
25. Josiah Gregg, COMMERCE OF THE PRAIRIES, ed. by Max L. Moorhead (Norman: University of Oklahoma Press, 1954,) p. 256.
26. Thomas Falconer, LETTERS AND NOTES ON THE TEXAS SANTA FE EXPEDITION, 1841-1842, ed. by F. W. Hodge (New York: Dauber and Pine, 1930), p. 110.
27. MARCY AND THE GOLD SEEKERS: *The Journal of Captain R. B. Marcy, With an Account of the Gold Rush Over the Southern Route*, ed. by Grant Foreman (Norman: University of Oklahoma Press, 1939), p. 232.
28. (Brevet Captain) John Pope, REPORT OF EXPLORATION OF A ROUTE FOR THE PACIFIC RAILROAD, House Executive Document No. 129, 33rd Congress, 1st Session (1854), p. 104. Pope did state elsewhere in his report that it appeared as if artesian wells could be drilled in the Llano Estacado along the proposed route of the railroad.

The Indians Of Texas, From Prehistoric to Modern Times.

W.W. Newcomb, Jr.

University of Texas Press, Austin 1961

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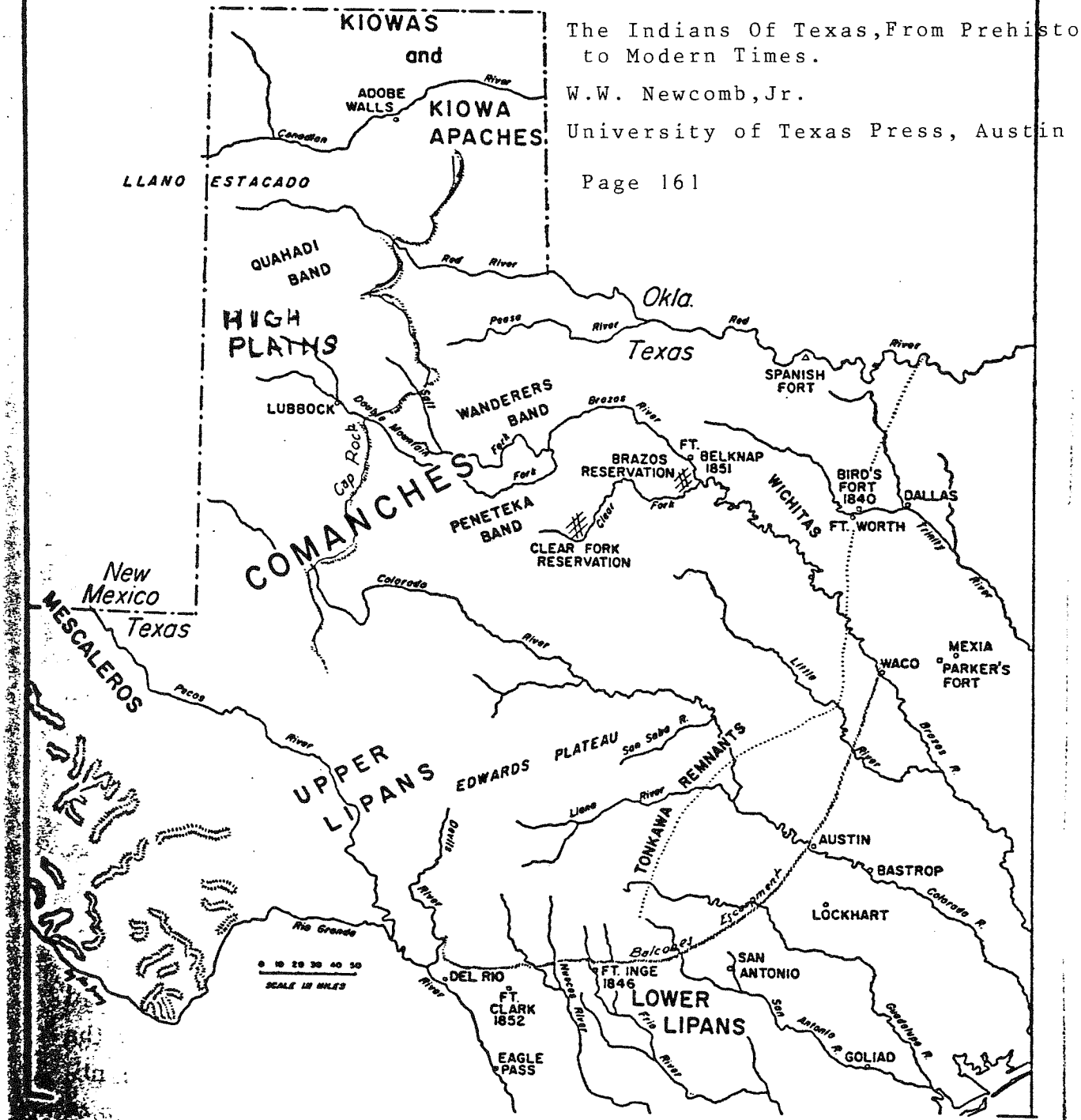

MAP 3. The Texas Plains, 19th Century

5789
5531
5557[a]
6382
5540
4284
6246
5129
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5305
6523[a]
5244
4991[a]
6054[a]
5983
4708
5420
5761
5458
5117
4971
5394
4885

4786[b]
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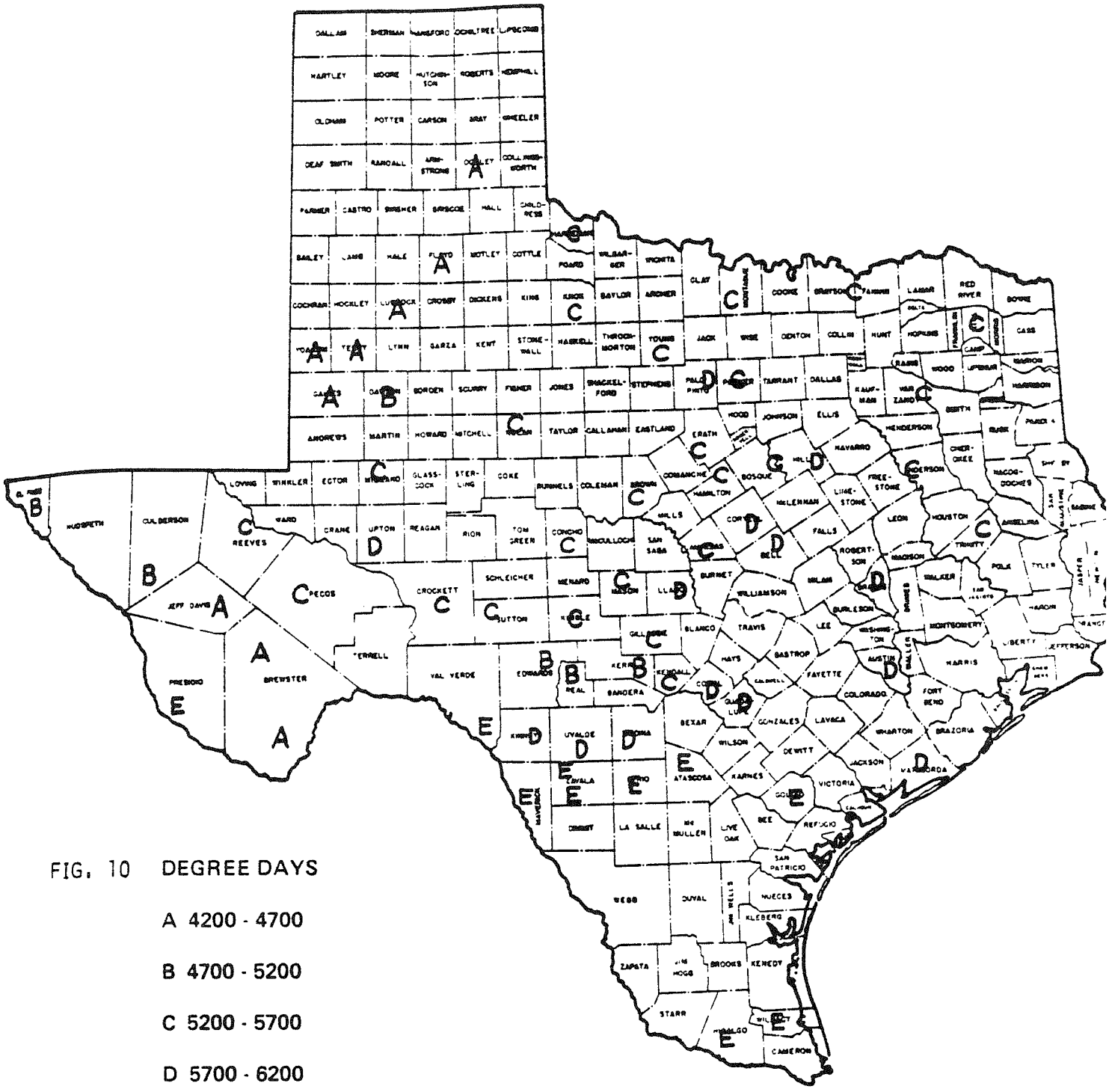


FIG. 10 DEGREE DAYS

A 4200 - 4700

B 4700 - 5200

C 5200 - 5700

D 5700 - 6200

E 6200 - +

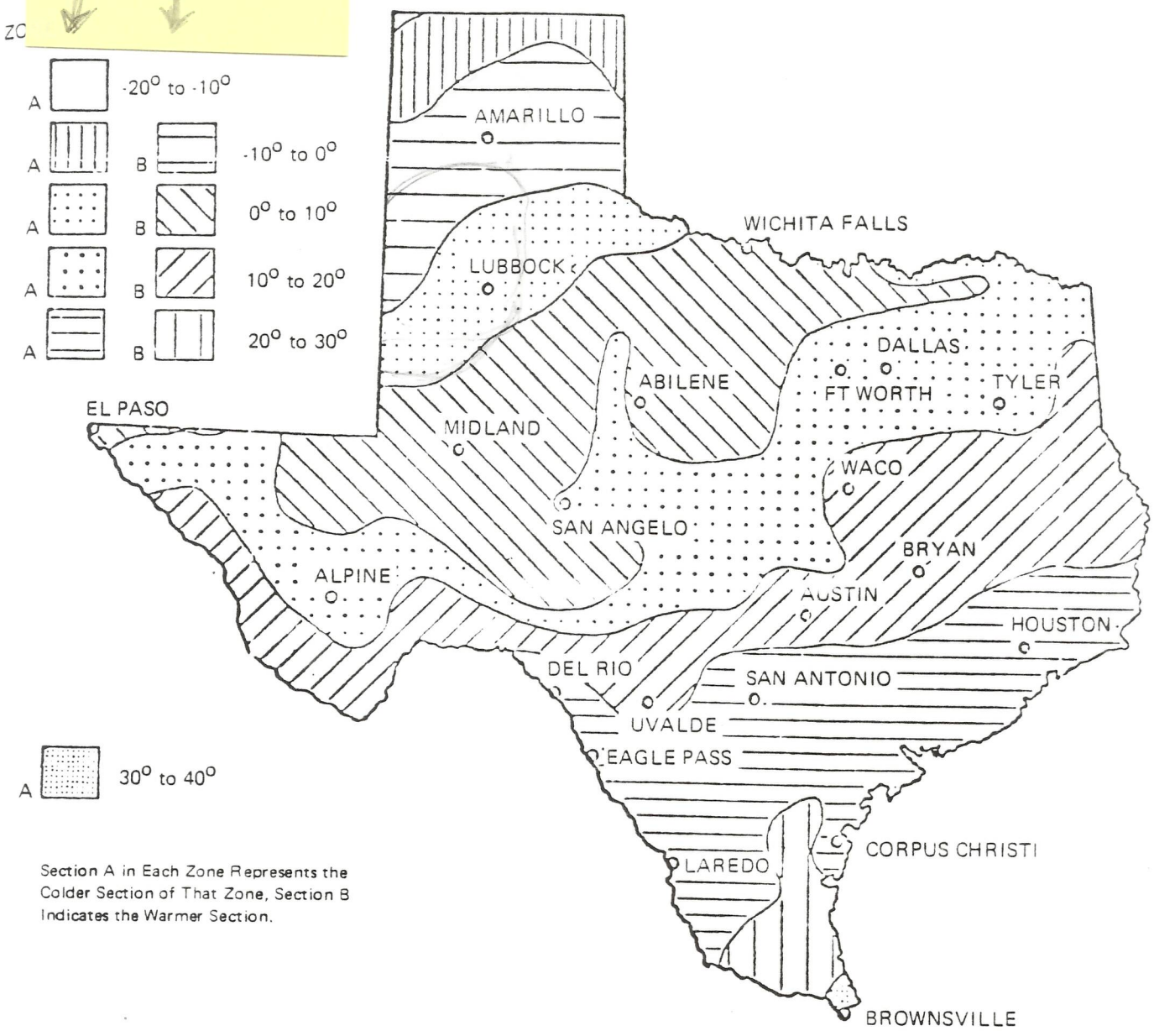


Fig. 13 Approximate range of average annual minimum temperatures for Texas (35).

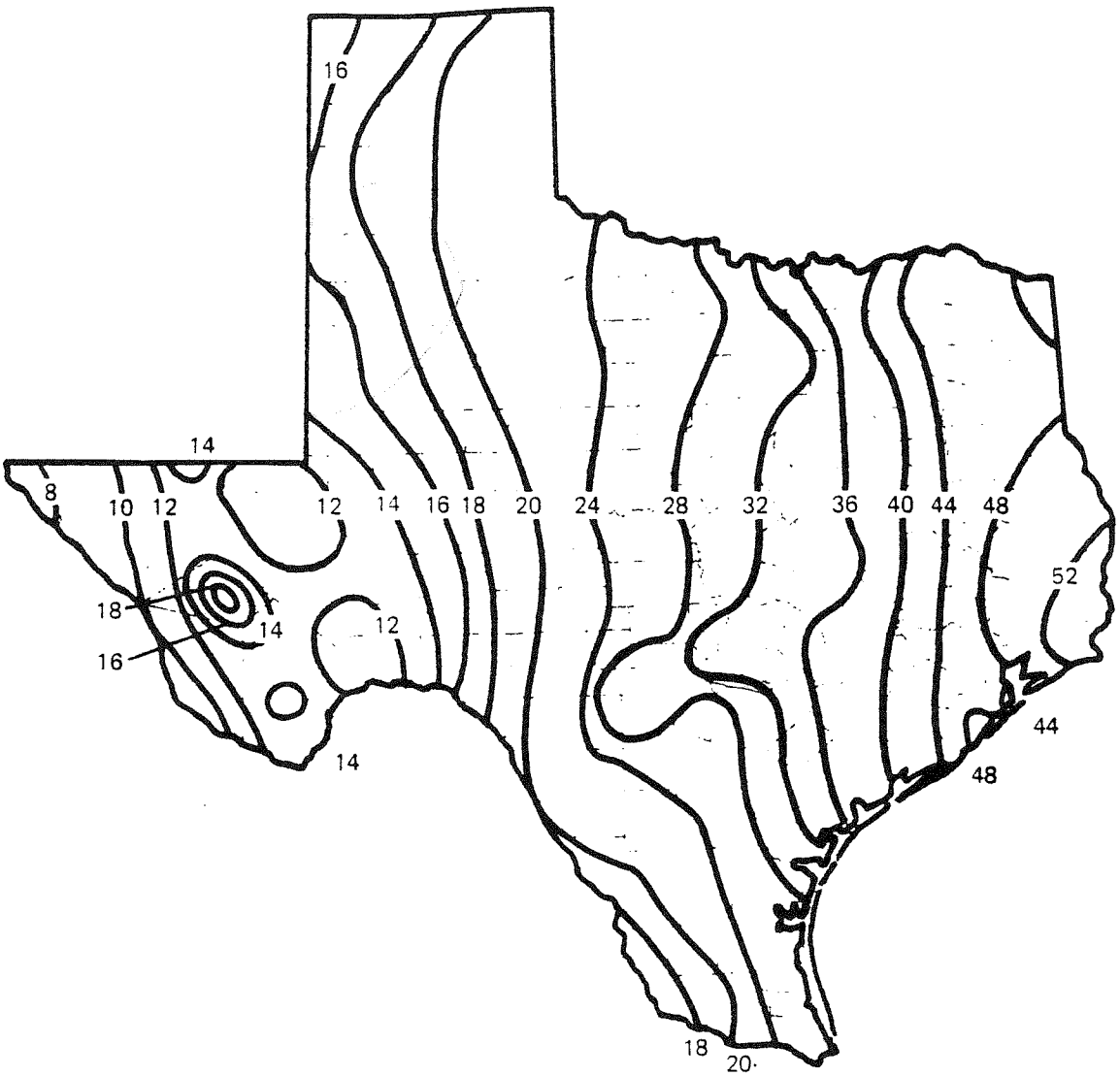


Fig. 24 Mean Annual Total Precipitation in Texas (46).

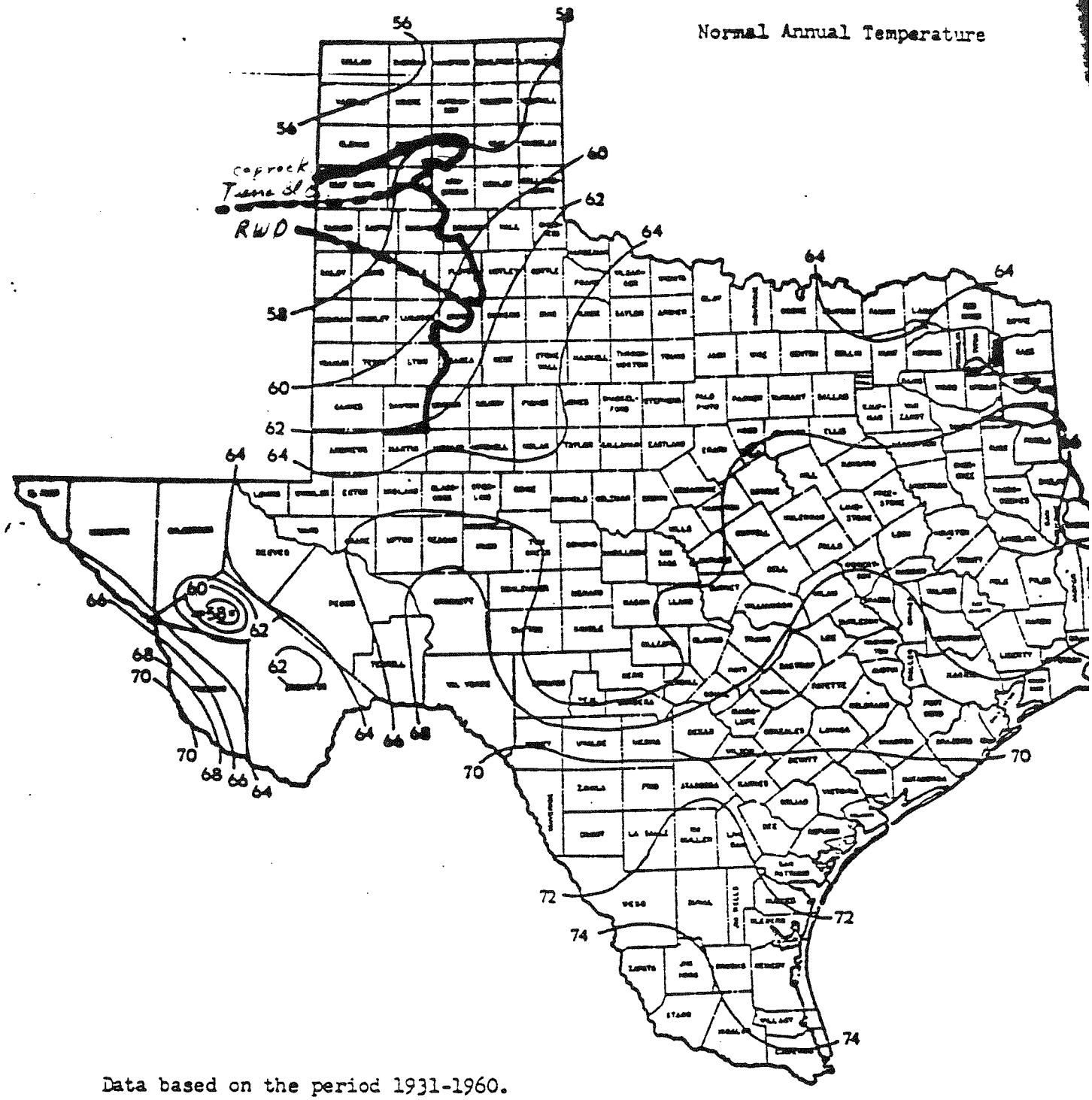
Figure 25 shows the average warm growing season precipitation from April through September (145).

Natural precipitation distribution during the growing season will determine the number and frequency of supplemental irrigation. On the average, July and August in most areas of Texas are relatively dry periods. The lack of rain during

October 1968

524.32.1

Normal Annual Temperature



Data based on the period 1931-1960.

WEATHER BUREAU STATE CLIMATOLOGIST
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
3600 MANOR ROAD, AUSTIN, TEXAS

(10)

STATION LOCATION

LUBBOCK, TEXAS

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above Sea level: Ground at temperature site	Elevation above Ground: Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	* Type M = AMOS T = AUTOB	Remarks
COOPERATIVE																	
Texas Agricultural Experimental Station 3 miles E of Post Office	3/20/11	Present		33° 35'	101° 48'	3215		4				4					Coordinates and elevations as of 11/26/58.
AIRPORT																	
Municipal Airport 5 miles N of Post Office	12/29/36	9/19/42		33° 39'	101° 50'	3241		a				a					Airway observer. a - Added 4/30/40.
Municipal Airport Hangar 5 miles N of City	11/06/46	8/17/48		33° 39'	101° 50'	3243	46	4	4				3				Weather Bureau Office established.
Municipal Airport Small Building	8/17/48	6/15/50	250' E	33° 39'	101° 50'	3243	46	5	5				3				
Terminal Building Municipal Airport	6/15/50	9/02/65	800' NNE	33° 39'	101° 50'	3243	68	6	5			4	4				Weighing gage installed 9/1/57.
Executive Air Terminal Municipal Airport † † Name changed to West Texas Air Terminal on 7/25/68 and Lubbock Regional Airport in 1970	9/02/65	Present	1 mile E	33° 39'	101° 49'	3254	25	c5	c5	%20	e18 g4	4 f4	44 f4	NA b5 h5	NA		b - Commissioned 3000 feet NE of Terminal Building temperature site 9/13/65. c - Added 09/29/71. % - Commissioned 11/01/72. d - Added 03/12/74. e - Added 08/20/74. f - Moved 100' NW 04/16/82. g - Moved to ground 04/16/82. h - Type change 07/16/85.

SUBSCRIPTION:
Price and ordering information available through: National Climatic Data Center, Federal Building, Asheville, North Carolina 28801

USCOMM-NOAA-ASHEVILLE, N.C. - 405

LUBBOCK, TEXAS

Lubbock is located on a plateau area of Northwestern Texas that is referred to locally as the South Plains Region. The general elevation of the area is about 3,250 feet. The Region is a major part of the Llano Estacado (staked plains). The latter, which includes a large portion of Northwest Texas, is bounded on the east and southeast by an erosional escarpment that is usually referred to as the Cap Rock. The Llano Estacado extends southwestward into the upper Pecos Valley and westward into eastern New Mexico.

The South Plains are predominately flat, but contain numerous small playas (or clay lined depressions) and small stream valleys. During the rainy months the playas collect run-off water and form small lakes or ponds. The stream valleys drain into the major rivers of West Texas, but throughout most of the year these streams carry only very light flows.

The escarpment, or Cap Rock, is the primary terrain feature that causes a noticeable distortion of the smooth wind flow patterns across the South Plains. The most noticeable influence is on southeasterly winds as they are deflected upward along the face of the escarpment.

The Lubbock area is the heart of the largest cotton-producing section of Texas. Grain sorghum production and cattle feeding make significant contributions to the agroeconomy of the area. Irrigation from underground sources is often used as a supplement to natural rainfall to improve crop yields. The soils of the region are sandy clay loams which consist of limy clays, silts, and sands of a reddish hue.

The area is semi-arid, transitional between the desert conditions on the west and the humid climates to the east and southeast. The greatest monthly rainfall totals occur from May through September when warm moist tropical air may be carried into the area from the Gulf of Mexico. This air mass often brings moderate to heavy afternoon and evening thunderstorms, accompanied by hail. Precipitation across the area is characterized by its variability. The monthly precipitation extremes range from trace amounts in several isolated months to 14 inches.

Snow may occur from late October until April. Each snowfall is generally light and seldom remains on the ground for more than two or three days at any one period.

High winds are associated primarily with intense thunderstorms and at times may cause significant damage to structures. Winds in excess of 25 mph occasionally occur for periods of 12 hours or longer. These prolonged winds are generally associated with late winter and springtime low-pressure centers. Spring winds often bring widespread dust causing discomfort to residents for periods of several hours.

Overall, the climate of the region is rated as pleasant. Most periods of disagreeable weather are of short duration. They generally occur from the winter months into the early summer months.

The summer heat is not considered oppressive. One moderating factor is a variable, but usually gentle, wind. Intrusions of dry air from the west often reduce any discomfort from the summer heat and lower temperatures into the 60s.

The average first occurrence of temperatures below 32 degrees Fahrenheit in the fall is the first of November and the average last occurrence in the spring is in mid April.

Historical Precipitation Measurements And Averages

AMARILLO PRECIPITATION—National Weather Service

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	.13	2.88	.50	2.76	5.88	.20	3.85	2.97	.83	.84	94	.95	22.73
1912	*	1.94	.82	.72	1.67	1.90	1.88	2.28	2.28	.39	.02	1.18	15.08
1913	.11	.55	.59	1.76	1.41	2.32	1.80	.61	4.19	.81	1.98	2.84	18.97
1914	.06	.10	.15	.95	4.43	.84	3.07	2.97	1.07	4.46	*	1.17	19.27
1915	.72	1.60	1.00	5.05	1.70	1.04	4.14	5.85	4.69	1.55	.18	.13	27 65
1916	.36	.02	.57	1.71	.89	2.18	.94	3.82	1.76	2.90	40	.88	16.43
1917	.69	22	.25	.71	2.49	.83	2.68	6.17	2.05	.34	.59	.04	17.06
1918	1.01	.26	1.06	.48	2.23	1.44	2.23	2.36	.64	2.47	1.16	2.78	18.12
1919	*	.73	1.73	2.56	2.08	2.94	1.75	3.21	4.58	.67	1.26	.50	22.01
1920	1.11	.18	.51	.64	2.57	2.56	1.85	5.52	3.04	1.87	1.33	.64	21.82
1921	2.10	1.19	.68	.39	2.09	7.75	4.17	5.77	.76	28	*	.06	25.24
1922	.78	1.44	4.06	3.25	1.60	3.77	1.04	.78	1.41	.23	1.39	.10	19.85
1923	.00	1.71	2.97	3.22	1.70	9.76	1.85	1.54	6.42	7 34	2.13	1.11	39.75
1924	.13	.56	1.75	.87	.67	2.82	3.66	3.57	1.13	.86	1.25	.63	17.90
1925	.51	.06	.11	1.33	1.94	1.71	5.13	3.19	4.88	3.35	.95	.37	23.53
1926	.48	.06	1.67	3.74	3.98	3.17	2.27	1.76	5.72	2.15	.29	.96	26.25
1927	.18	.23	.46	1.95	.07	1.51	1.68	5.31	3.40	.14	.02	.47	15.42
1928	*	1.11	.86	.77	6.48	3.45	5.39	6.15	1.31	2.77	3.54	.51	32.34
1929	.16	.34	1.84	*	3.19	.77	1.76	4.54	1.97	3.28	.91	.11	18.87
1930	.57	.00	1.27	2.19	1.49	4.47	2.42	1.61	.20	2.57	.33	.46	17.58
1931	.31	1.83	1.69	1.57	3.11	.69	1.40	2.19	.51	.92	2.89	1.24	18.35
1932	1.60	.41	.42	2.21	1.02	9.24	1.22	.70	2.79	.64	.02	.87	21.14
1933	.02	.29	.56	.64	2.01	.05	.66	6.02	.88	.49	.58	.02	12.22
1934	.09	.09	2.83	.77	3.21	1.94	.19	1.51	.96	.21	1.13	.40	13.33
1935	.75	.22	1.14	.05	2.57	.28	.81	5.32	2.03	.87	1.27	.18	15.49
1936	1.02	.25	*	.25	9.02	.84	.51	1.39	4.74	.82	*	.88	19.72
1937	.29	.18	1.10	.39	6.83	2.83	1.49	.64	2.61	.31	.14	.29	17.10
1938	.18	2.87	1.24	1.07	4.03	2.49	1.88	.15	1.62	3.06	.43	.08	19.10
1939	2.51	.17	.25	2.30	1.75	7.59	.57	3.28	.45	1.10	.06	.98	21.01
1940	.52	.88	.24	1.10	2.68	1.64	.88	.71	.54	.29	3.87	.27	13.62
1941	.40	.94	2.55	1.29	7.47	5.07	3.36	3.18	4.30	7.64	.33	.68	37.21
1942	.06	.63	.42	3.74	.91	2.29	.80	3.95	1.45	6.18	*	1.18	21.61
1943	.08	*	.01	1.06	1.82	1.01	6.64	2.09	.79	.72	.39	3.77	18.38
1944	1.67	.72	*	1.83	3.72	4.33	5.06	1.40	2.08	.84	.75	1.20	23.60
1945	.77	.28	.41	1.58	.42	1.61	1.62	5.17	4.02	1.31	*	*	17.19
1946	1.05	.33	.66	.55	.82	2.37	.12	3.96	3.25	5.73	.78	1.18	20.80
1947	32	.07	.77	2.07	4.59	3.19	1.54	.39	.24	12	.92	1.26	15.48
1948	.63	1.83	.72	.73	2.82	4.92	1.52	5.16	1.27	2.58	2.11	.09	24.38
1949	2.04	.59	.57	1.99	6.43	2.82	3.90	3.78	1.69	1.03	.01	.30	25.15
1950	*	.20	*	.64	1.83	3.25	7.32	4.54	5.02	*	.03	.35	23.18
1951	.38	1.17	.55	.43	9.81	4.34	2.01	1.52	2.01	2.37	.25	.45	25.29
1952	.53	.24	.56	2.46	2.05	1.75	1.36	.88	.32	.00	1.44	.50	12.09
1953	.64	.53	.38	.62	.70	.01	1.81	2.00	.26	4.56	.56	.98	13.05
1954	.25	.09	.17	2.31	4.44	1.95	.55	2.91	.30	.73	*	.19	13.89
1955	.53	.06	.33	.38	2.70	1.49	3.35	1.49	3.13	.13	.02	.10	13.71
1956	.09	1.10	.03	.23	1.99	2.03	2.82	.79	.48	.38	*	*	9.94
1957	.33	1.11	2.82	2.69	4.36	.53	.13	4.85	.88	2.57	.94	.03	21.24
1958	1.05	.58	2.36	1.74	2.45	4.22	6.16	2.08	1.60	.15	.60	.30	23.29
1959	.16	.06	.26	1.18	4.82	2.19	2.85	2.24	2.29	2.10	.14	4.32	22.81
1960	1.30	.95	1.66	1.66	.82	9.85	7.59	3.15	4.22	4.82	*	.65	36.67
1961	.12	.27	2.55	.24	3.40	3.42	4.10	3.14	1.87	.91	2.26	.16	22.44
1962	.47	.39	.02	1.48	1 76	10.16	7.51	3.29	2.66	.85	.53	.64	29.76
1963	.06	.67	.28	.47	3.66	3.60	2.04	3.93	.43	1.54	.33	.29	17.30
1964	*	1.37	.03	*	1.69	1.90	.94	5.69	3.95	.08	1.53	.79	17.97
1965	.55	.47	.72	.23	1.88	10.73	1.54	1.71	.79	1.02	.07	.38	20.09
1966	.43	.69	.01	.87	.19	4.62	1.37	3.77	2.40	.29	.08	.19	14.91
1967	*	.15	.42	1.95	1.40	2.55	3.70	1.81	2.47	1.61	.28	.51	16.85
1968	2.33	.73	.45	.93	2.84	1.68	2.96	3.35	.62	.90	.92	.26	17.97
1969	.02	.50	1.15	.30	2.93	4.09	2.55	4.51	2.77	2.56	.34	.83	22.55
1970	.02	.02	2.10	1.33	.23	1.54	1.39	1.27	.34	1.06	26	*	9.56
1971	.10	1.65	.10	.77	.91	4.17	1.75	3.33	4.70	2.59	2.08	.89	23.04
1972	.21	.11	.11	.03	2.81	3.87	2.59	1.73	.71	1.66	1.19	.32	15.34
1973	.56	.42	3.99	1.88	1.43	84	4.08	2.31	1.22	1.05	.10	.17	18.05
1974	.33	.24	.60	.04	4.06	3.33	1.31	7.55	1.65	3.44	.12	.42	23.09
1975	.28	1.33	.51	1.02	2.47	4.15	5.19	3.97	.76	.33	.92	.15	21.08
1976	*	.10	.79	1.65	1.36	2.94	1.77	1.78	4.28	1.14	.43	*	16.24
1977	.64	.53	.24	2.74	4.01	2.06	3.14	4.94	.03	.26	.32	.27	19.18
1978	.63	.80	.21	.55	5.76	6.50	1.82	1.61	2.42	97	.47	.27	22.01
1979	.92	.28	1.46	1.29	3.94	3.19	2.03	5.08	.52	1.28	.40	.07	20.46
1980	.85	.55	1.38	.82	2.88	1.30	.65	1.80	1.55	.42	.84	.35	13.39
1981	.11	.23	1.87	.90	2.11	1.04	2.73	5.22	3.47	1.79	1.50	.03	21.00
1982	.15	.39	.52	.43	1.96	4.75	6.23	.55	1.37	.71	.75	.79	18.60
1983	1.78	1.19	.98	.83	2.85	1.76	.74	.28	.37	3.23	.33	.64	14.98
1984	.56	.37	.98	1.18	04	6.76	.83	2.28	.95	3.19	1.09	.89	19.12
1985	.99	.77	1.49	2.79	.86	3.08	2.07	1.67	4.96	3.07	39	.26	22.40
1986	00	1.02	.60	.30	3.28	3.70	3.52	7.04	1.45	1.94	1.82	.66	25.33
1987	1.26	.84	.92	57	4.28	3.29	.83	3.28	3.40	1.17	.43	1.75	22.02
1988	.33	.04	1.19	2.22	6.02	3.68	3.30	3.59	3.15	.71	.29	.17	24.69
1989	.16	.55	52	.75	2.51	6.07	2.74	3.22	1.80	.74	.00	.49	19.55
Average	.54	.64	93	1.31	2.83	3.20	2.52	3.05	2.10	1.68	.74	.65	20.19

* Trace

LUBBOCK PRECIPITATION—National Weather Service

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	.38	5.83	.43	2.36	.72	.28	6.75	.21	1.33	1.08	.22	1.55	21.14
1912	.02	1.28	.61	.50	1.58	.96	3.35	2.37	.73	2.81	.01	.38	14.60
1913	.04	.20	1.18	1.82	.24	5.88	.40	.32	4.19	1.53	1.54	2.13	19.47
1914	.15	.10	.29	1.47	4.04	3.86	6.17	5.95	.46	7.12	.35	1.47	31.43
1915	.09	3.00	2.52	6.18	1.52	4.01	1.42	2.96	7.86	1.52	.04	.76	31.88
1916	.17	*	1.15	2.63	.39	1.52	.36	2.45	2.79	2.91	.55	.11	15.03
1917	.35	.05	.21	.58	1.07	.64	1.42	1.16	3.03	.14	.08	*	8.73
1918	.84	.58	.05	.72	1.67	2.95	.53	.79	.79	.51	.69	2.03	12.15
1919	.12	.25	3.39	3.53	2.10	3.52	2.28	2.83	5.70	7.34	.36	.19	31.61
1920	.90	.11	.24	.15	2.91	3.66	2.19	2.64	1.63	1.43	2.21	.09	18.16
1921	.14	.45	1.47	.24	.43	7.71	.84	.92	4.50	.02	*	*	16.72
1922	.34	.20	.55	3.59	3.50	2.43	1.36	.28	.17	.60	1.50	.07	14.59
1923	.24	.76	1.04	3.18	2.77	3.98	1.65	1.59	2.67	6.80	.85	.64	26.17
1924	*	.17	.96	.86	.90	1.79	1.20	1.76	1.25	.47	.03	.06	9.45
1925	.65	.02	*	1.12	2.31	.86	3.38	3.32	9.44	1.33	.11	.21	22.75
1926	.56	.04	1.64	1.81	5.14	1.10	1.03	2.75	4.15	8.40	.67	1.77	29.06
1927	.79	.37	*	.40	*	2.91	2.16	.59	1.16	.40	*	.81	9.59
1928	.31	1.18	*	.09	3.08	1.06	6.78	4.04	.08	2.10	.74	.28	19.74
1929	.43	.34	2.03	.15	6.91	.90	.20	1.68	1.36	3.56	1.00	.07	18.63
1930	.61	.03	.45	1.04	1.71	1.70	.12	1.34	.11	3.91	.94	1.44	13.40
1931	.32	1.98	1.34	1.82	1.32	.95	2.17	2.44	.72	3.47	1.39	1.44	19.36
1932	.93	1.09	.04	1.84	2.37	5.66	1.90	3.15	3.41	1.29	*	2.48	24.16
1933	.37	.95	.02	.06	2.97	.21	1.36	2.19	.71	.42	.99	.06	10.31
1934	.06	.06	1.98	1.08	1.26	.28	.65	1.66	1.86	.28	.55	*	9.72
1935	.12	.60	.89	.04	3.49	2.57	1.25	1.69	3.02	1.22	2.04	.33	17.26
1936	1.08	*	.59	.92	5.86	.92	1.13	.13	13.93	1.52	.74	.21	27.03
1937	.26	.01	1.81	2.01	4.00	3.12	1.32	2.06	3.85	3.22	.07	.52	22.25
1938	.91	1.18	.49	.14	1.99	5.89	4.01	.47	.63	.51	.27	.03	16.52
1939	2.45	.19	.09	.28	1.82	.67	1.73	2.75	.01	.94	.18	.60	11.71
1940	.23	1.97	*	1.84	1.74	2.06	*	1.57	.73	1.07	2.35	.20	13.76
1941	.55	.61	3.56	2.23	12.69	4.13	3.68	1.85	4.47	5.89	.17	.72	40.55
1942	.04	.18	.51	3.25	.35	1.74	2.58	4.97	7.61	3.39	.01	2.70	27.33
1943	.04	.02	.25	.53	2.71	2.37	3.17	*	1.16	.10	.62	1.87	12.84
1944	1.28	1.36	1.09	.84	3.03	1.75	2.93	2.37	3.73	.80	1.72	1.64	22.54
1945	.69	.39	.10	.46	.46	.36	3.08	2.17	2.22	2.26	.27	.32	12.78
1946	1.18	.15	.76	.07	1.49	2.72	.58	3.55	3.49	4.67	.44	1.04	20.14
1947	.73	.02	.69	1.06	6.35	1.56	1.06	.06	.08	.37	1.43	.52	13.93
1948	.14	1.38	.17	.33	2.88	2.31	1.75	.31	1.45	.98	.03	.13	11.86
1949	4.05	.29	.80	1.84	7.80	4.65	1.18	2.07	4.76	1.49	*	.43	29.36
1950	.28	.18	*	.88	3.93	.68	3.12	2.08	3.74	.14	.03	.03	15 09
1951	.32	.66	.78	.58	2.63	4.19	2.04	2.62	.70	.93	.06	.02	15.53
1952	.98	.05	.04	2.30	1.39	1.94	3.24	1.88	.92	.00	.96	.06	13.76
1953	.34	.16	1.07	.62	1.37	.45	1.47	2.57	.04	4.01	.16	.05	12.31
1954	.06	.00	.04	1.91	4.45	.51	.19	2.92	.00	2.82	*	1.09	13.99
1955	.83	.00	.03	.19	2.45	2.30	3.03	.62	2.76	4.53	.10	.00	16.84
1956	.01	1.59	.00	.36	1.80	3.26	.69	1.06	.03	1.73	*	.30	10.83
1957	.08	.73	.98	3.48	6.43	4.96	1.54	.32	.51	4.20	1.27	.06	24.56
1958	1.35	.33	3.23	1.97	2.94	.71	2.65	.21	2.90	.94	.34	.02	17.59
1959	.08	.07	.00	1.28	2.15	7.25	1.30	.72	.89	.98	.02	1.47	16.21
1960	.66	.94	.61	.26	1.16	5.72	5.37	.05	.34	5.83	.00	1.25	22.19
1961	.56	2.51	1.34	.10	2.05	4.03	4.06	1.78	.18	.55	1.31	.35	18.82
1962	.26	.02	.10	1.20	.10	2.56	4.85	1.31	4.17	2.66	.45	.67	18.35
1963	.06	.54	.73	.25	6.79	2.10	.37	2.67	.78	.59	1.13	.20	16.21
1964	.45	.16	.64	.11	1.67	5.00	.82	1.14	2.46	.30	.57	.90	14.22
1965	.08	.35	.22	.41	1.63	1.44	2.14	.62	5.68	1.06	.02	.50	14.15
1966	.52	.06	.13	3.03	.67	2.27	.57	8.85	2.18	.00	.11	.03	18.42
1967	.00	.14	2.09	.95	3.45	7.95	3.29	.71	.98	.45	.11	.52	20.64
1968	.94	.82	2.77	.58	2.01	1.81	3.14	2.72	.67	.81	2.67	.48	19.42
1969	.00	1.13	1.77	1.14	3.88	1.41	2.99	2.59	4.93	7.76	.77	.82	29.19
1970	.00	.11	2.15	.26	4.30	1.36	.00	1.18	1.80	1.34	.05	.08	12.63
1971	.00	.81	.21	1.36	2.44	2.25	.76	4.15	5.22	1.79	.43	.81	20.23
1972	.16	.13	*	.35	3.20	5.37	4.47	5.40	2.95	1.75	.97	.32	25.07
1973	1.44	1.26	1.90	1.40	.43	.32	4.16	.36	.73	.89	*	*	12.89
1974	.08	.01	1.56	.82	1.23	1.11	2.22	5.14	6.62	3.89	.89	.44	24.01
1975	.41	1.53	.04	.45	2.74	1.80	4.32	2.21	2.61	.06	1.18	.34	17.69
1976	*	.03	.24	1.76	1.19	2.46	7.20	1.99	3.28	1.39	.56	.01	20.11
1977	.24	.38	.82	2.90	2.46	2.28	1.13	4.31	.49	1.11	.02	.01	16.15
1978	.59	1.39	.23	.21	3.20	1.93	.15	.34	3.29	1.06	1.11	.17	13.67
1979	.33	.85	2.95	1.17	4.00	3.69	1.84	3.81	.21	.59	.09	1.29	20.82
1980	.54	.38	.19	1.13	3.46	1.78	.20	1.64	3.55	.19	2.29	.51	15.86
1981	.32	.67	1.19	2.05	1.25	.79	3.35	5.41	1.78	5.34	.64	.20	22.99
1982	.05	.39	.44	2.53	4.54	4.99	2.08	1.08	1.29	.48	1.18	1.95	21.00
1983	2.75	.32	.55	.77	1.23	1.79	.41	.32	.39	10.80	.54	.36	20.23
1984	.03	.17	.23	.23	.45	4.32	.53	3.72	.15	1.74	1 87	1 18	14.62
1985	.38	24	1.19	.48	2.97	4.51	3.94	63	4.73	3 60	.27	18	23.12
1986	.00	.94	.39	.72	1.82	4.92	1.41	3.60	6.90	2.89	1.73	1 29	26.61
1987	.54	1.47	.41	.09	3.30	2.40	4.29	1.68	2.67	77	11	1 09	18.82
1988	22	.45	.79	1.08	2.64	1.03	2.93	.92	2.29	02	19	56	13 12
1989	50	1.04	.70	.04	39	4.98	.26	3.05	3.74	*	*	31	15.01
Average	.49	.64	.84	1.20	2.63	2.66	2.17	2.07	2.54	2.12	62	62	18.62

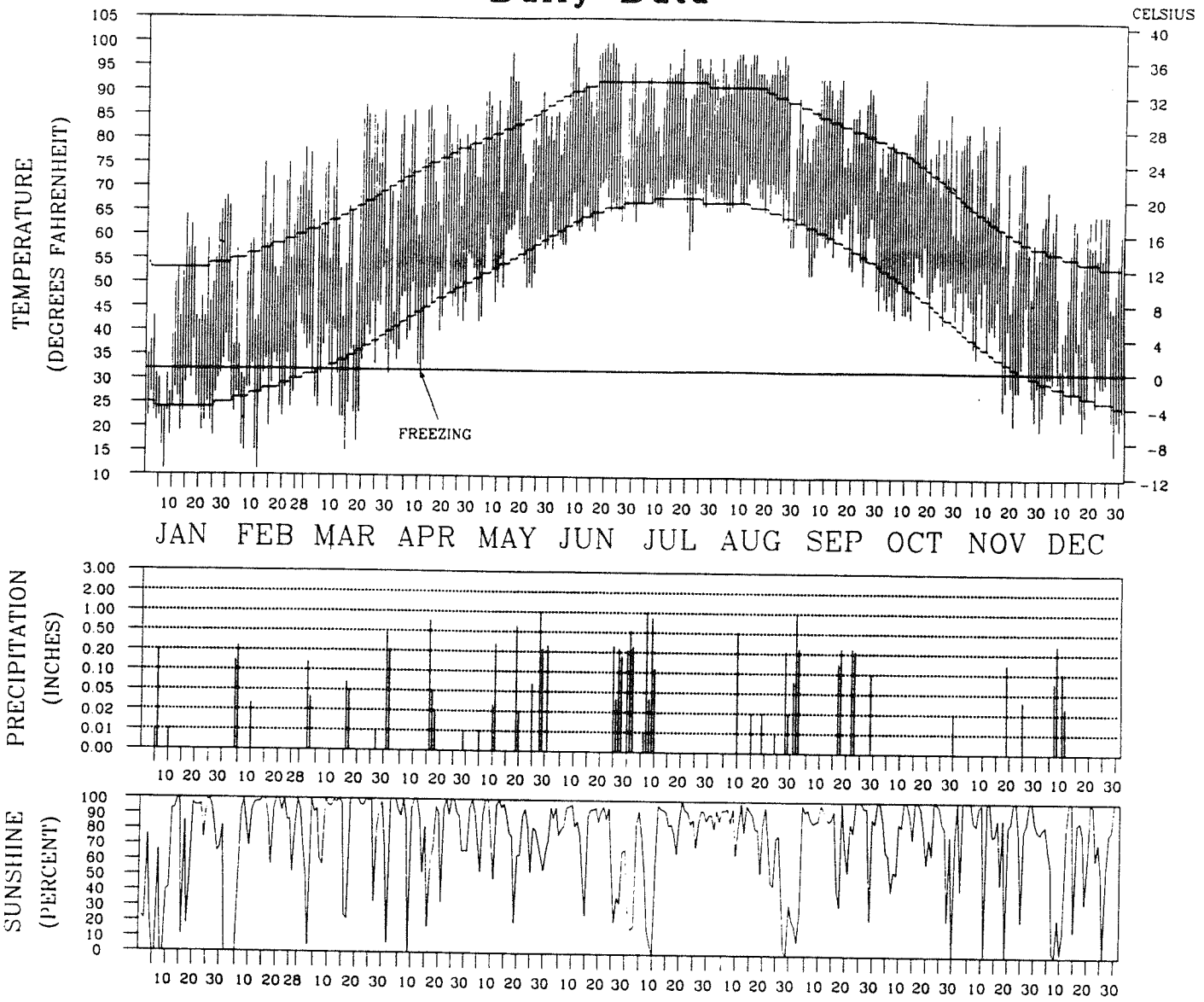
* Trace

ISSN 0198-5108

1988 LOCAL CLIMATOLOGICAL DATA
ANNUAL SUMMARY WITH COMPARATIVE DATA

LUBBOCK,
TEXAS

Daily Data



TEMPERATURE DEPICTS NORMAL MAXIMUM, NORMAL MINIMUM AND ACTUAL DAILY HIGH AND LOW VALUES (FAHRENHEIT)
PRECIPITATION IS MEASURED IN INCHES, SCALE IS NON-LINEAR
SUNSHINE IS PERCENT OF THE POSSIBLE SUNSHINE

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE

NATIONAL CLIMATIC DATA CENTER ASHEVILLE NORTH CAROLINA

Kenneth D Hadeen
DIRECTOR
NATIONAL CLIMATIC DATA CENTER

METEOROLOGICAL DATA FOR 1988

LUBBOCK, TEXAS

LATITUDE: 33°39' N LONGITUDE: 101°49' W ELEVATION: FT. GRND 3254 BARO 3258 TIME ZONE: CENTRAL WBAN: 23042

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F:													
Averages													
-Daily Maximum	47.5	57.6	67.4	75.3	82.5	91.5	90.8	92.1	84.7	77.5	67.7	55.8	74.2
-Daily Minimum	25.1	27.9	32.8	44.5	55.1	64.4	67.8	67.2	58.1	48.2	36.1	28.0	46.3
-Monthly	36.3	42.8	50.1	59.9	68.8	78.0	79.3	79.7	71.4	62.9	51.9	41.9	60.3
-Monthly Dewpt.	23.8	26.5	24.4	34.9	48.7	57.5	63.9	63.1	54.5	43.8	25.2	21.0	40.6
Extremes													
-Highest	68	78	87	87	98	102	99	98	93	93	84	70	102
-Date	30	28	21	20	15	9	18	25	16	17	14	3	JUN 8
-Lowest	11	11	15	31	42	58	57	58	45	41	20	15	11
-Date	7	11	14	11	3	5	21	29	30	19	30	28	FEB 11
DEGREE DAYS BASE 65 °F:													
Heating	881	638	459	168	32	0	0	6	11	95	388	707	3385
Cooling	0	0	6	24	158	394	450	467	210	37	3	0	1749
% OF POSSIBLE SUNSHINE	61	73	82	78	77	77	71	73	77	78	81	63	75
AVG. SKY COVER (tenths)													
Sunrise - Sunset	6.3	4.8	3.6	4.0	4.8	5.3	5.2	5.4	4.4	3.2	2.7	5.1	4.6
Midnight - Midnight	5.6	4.3	3.1	3.9	4.8	5.0	5.1	5.0	3.8	2.9	2.2	4.0	4.1
NUMBER OF DAYS:													
Sunrise to Sunset													
-Clear	9	14	18	16	11	13	11	9	12	17	19	13	162
-Partly Cloudy	7	5	6	8	11	7	9	14	10	11	8	7	103
-Cloudy	15	10	7	6	9	10	11	8	8	3	3	11	101
Precipitation .01 inches or more	3	3	6	5	9	5	7	7	7	1	2	4	59
Snow, Ice pellets 1.0 inches or more	0	2	0	0	0	0	0	0	0	0	1	1	4
Thunderstorms	0	0	2	5	8	9	10	9	5	0	0	0	48
Heavy Fog, visibility 1/4 mile or less	4	4	0	0	0	1	0	0	0	6	0	0	15
Temperature °F													
-Maximum													
90° and above	0	0	0	0	6	19	21	25	9	1	0	0	81
32° and below	6	2	1	0	0	0	0	0	0	0	0	0	9
-Minimum													
32° and below	27	20	14	1	0	0	0	0	0	0	11	25	98
0° and below	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG. STATION PRESS. (mb)	907.2	907.0	903.2	901.8	902.5	904.7	905.9	904.5	904.2	906.9	902.1	907.6	904.8
RELATIVE HUMIDITY (%)													
Hour 00	75	69	50	52	66	65	74	71	72	64	46	57	63
Hour 06 (Local Time)	82	80	60	70	79	80	87	84	82	78	57	65	75
Hour 12	57	53	37	34	44	45	54	50	50	44	29	40	45
Hour 18	51	45	28	29	36	37	47	47	42	38	29	38	39
PRECIPITATION (inches):													
Water Equivalent													
-Total	0.22	0.45	0.79	1.08	2.64	1.03	2.93	0.92	2.29	0.02	0.19	0.56	13.12
-Greatest (24 hrs)	0.21	0.42	0.48	0.83	1.17	0.33	1.07	0.54	1.00	0.02	0.15	0.42	1.17
-Date	5- 6	4- 5	31	16-17	28-29	25-26	7- 8	10	1- 2	30	19	7- 8	MAY 28-29
Snow, Ice pellets													
-Total	0.9	4.7	0.4	T	0.0	0.0	0.0	0.0	0.0	0.0	1.4	3.6	11.0
-Greatest (24 hrs)	0.8	4.4	0.4	T	0.0	0.0	0.0	0.0	0.0	0.0	1.4	3.6	4.4
-Date	5- 6	4- 5	3	1							19	7- 8	FEB 4- 5
WIND:													
Resultant													
-Direction (!!!)	227	341	251	239	176	154	168	171	163	160	240	255	191
-Speed (mph)	2.7	0.9	2.3	1.9	4.6	5.7	6.8	6.0	4.7	2.8	5.7	3.8	3.1
Average Speed (mph)	12.5	12.5	15.8	14.3	16.5	12.4	11.1	10.6	11.0	10.9	12.9	12.9	12.8
Fastest Obs. 1 Min.													
-Direction (!!!)	22	34	05	28	16	35	22	20	31	36	26	23	23
-Speed (mph)	30	41	43	44	38	30	26	29	44	28	46	48	48
-Date	18	14	31	24	1	30	23	10	22	1	15	19	DEC 19
Peak Gust													
-Direction (!!!)	W	N	NE	W	NW	S	N	SW	NW	S	W	SW	W
-Speed (mph)	45	54	59	61	53	44	36	53	58	41	60	59	61
-Date	18	14	31	24	22	12	1	10	22	6	15	19	APR 24

(!!!) See Reference Notes on Page 68

NORMALS, MEANS, AND EXTREMES

LUBBOCK, TEXAS

LATITUDE: 33°39'N LONGITUDE: 101°49' W ELEVATION: FT. GRND 3254 BARO 3258 TIME ZONE: CENTRAL WBAN: 23042

	(a)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F:														
Normals														
-Daily Maximum		53.3	57.3	65.1	74.8	82.8	90.8	91.9	90.1	83.6	74.7	62.1	55.5	73.5
-Daily Minimum		24.3	27.9	35.2	45.8	55.2	64.3	67.6	65.7	58.7	47.3	34.8	27.4	46.2
-Monthly		38.8	42.6	50.2	60.3	69.0	77.6	79.8	77.9	71.2	61.0	48.5	41.5	59.9
Extremes														
-Record Highest	42	83	87	94	96	104	108	108	106	103	98	86	81	108
-Year		1972	1979	1971	1987	1947	1980	1983	1966	1948	1979	1980	1958	JUL 1983
-Record Lowest	42	-16	-8	2	22	30	44	51	52	33	23	-1	0	-16
-Year		1963	1960	1948	1948	1967	1947	1952	1956	1983	1980	1957	1983	JAN 1963
NORMAL DEGREE DAYS:														
Heating (base 65°F)		812	627	470	178	33	0	0	0	15	157	495	729	3516
Cooling (base 65°F)		0	0	11	37	157	378	459	400	201	33	0	0	1676
% OF POSSIBLE SUNSHINE	16	65	67	73	74	72	76	78	77	71	72	68	65	72
MEAN SKY COVER (tenths)														
Sunrise - Sunset	40	5.3	5.1	5.0	4.8	5.0	4.2	4.3	4.2	4.4	3.9	4.4	4.8	4.6
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	42	12.5	10.9	11.8	12.8	11.2	13.4	14.3	15.1	14.4	16.4	14.7	13.5	160.9
-Partly Cloudy	42	6.4	7.3	8.7	8.3	11.2	10.8	10.8	9.9	8.0	6.8	6.9	7.0	102.1
-Cloudy	42	12.1	10.1	10.5	8.9	8.6	5.8	6.0	6.0	7.6	7.8	8.4	10.5	102.2
Precipitation .01 inches or more	42	3.6	4.1	4.0	4.4	7.5	7.0	6.8	6.6	6.0	5.1	3.5	4.0	62.5
Snow, Ice pellets 1.0 inches or more	42	0.8	1.0	0.5	0.*	0.0	0.0	0.0	0.0	0.0	0.*	0.3	0.6	3.4
Thunderstorms	42	0.1	0.5	1.9	3.6	8.7	9.1	7.5	7.1	4.5	2.8	0.8	0.3	46.8
Heavy Fog Visibility 1/4 mile or less	42	2.9	2.9	1.5	0.9	1.1	0.4	0.1	0.3	1.2	1.9	2.4	1.8	17.5
Temperature °F		..	..	..	..	..	..	..	..	..	..	..	..	..
-Maximum														
90° and above	41	0.0	0.0	0.*	1.6	8.0	18.0	22.1	19.5	8.6	0.9	0.0	0.0	78.6
32° and below	41	3.3	1.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.6	6.8
-Minimum														
32° and below	41	25.7	19.2	11.0	1.9	0.1	0.0	0.0	0.0	0.0	0.9	12.0	23.8	94.6
0° and below	41	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.1	0.6
AVG. STATION PRESS. (mb)	16	905.5	904.2	901.2	901.7	901.1	902.9	904.9	905.1	905.0	905.6	904.7	905.3	903.9
RELATIVE HUMIDITY (%)														
Hour 00	41	66	64	56	54	62	63	61	65	69	68	65	66	63
Hour 06 (Local Time)	41	73	73	68	68	76	77	75	78	80	79	74	72	74
Hour 12	41	50	50	41	39	43	45	47	49	52	49	46	48	47
Hour 18	41	47	42	33	32	37	37	39	42	45	45	46	48	41
PRECIPITATION (inches):														
Water Equivalent														
-Normal		0.38	0.57	0.90	1.08	2.59	2.81	2.34	2.20	2.06	1.81	0.59	0.43	17.76
-Maximum Monthly	42	4.05	2.51	3.23	3.48	7.80	7.95	7.20	8.85	6.90	10.80	2.67	1.95	10.80
-Year		1949	1961	1958	1957	1949	1967	1976	1966	1986	1983	1968	1982	OCT 1983
-Minimum Monthly	42	0.00	T	T	0.09	0.10	0.32	T	0.05	T	0.00	0.00	T	0.00
-Year		1967	1955	1972	1987	1962	1973	1970	1960	1954	1952	1960	1973	JAN 1967
-Maximum in 24 hrs	42	1.56	2.15	1.80	2.18	5.14	5.70	3.25	3.78	2.80	5.82	1.57	1.12	5.82
-Year		1983	1961	1973	1982	1949	1967	1985	1966	1965	1983	1968	1959	OCT 1983
Snow, Ice pellets														
-Maximum Monthly	40	25.3	16.8	14.3	5.3	0.0	0.0	0.0	0.0	0.0	7.5	21.4	9.9	25.3
-Year		1983	1956	1958	1983						1976	1980	1960	JAN 1983
-Maximum in 24 hrs	40	16.3	12.1	10.0	4.5	0.0	0.0	0.0	0.0	0.0	4.7	10.8	6.3	16.3
-Year		1983	1961	1969	1983						1976	1980	1960	JAN 1983
WIND:														
Mean Speed (mph)	39	12.1	13.3	14.8	14.8	14.2	13.6	11.3	10.0	10.5	11.1	11.6	11.9	12.4
Prevailing Direction through 1963		SW	SW	SW	SW	S	S	S	S	S	S	WSW	WSW	S
Fastest Obs. 1 Min.														
-Direction (!!!)	40	28	25	34	25	36	05	25	16	36	25	25	25	36
-Speed (MPH)	40	59	58	69	58	70	63	64	46	45	65	59	58	70
-Year		1965	1960	1957	1956	1952	1955	1950	1956	1953	1957	1955	1957	MAY 1952
Peak Gust														
-Direction (!!!)	5	N	N	SW	S	SW	NE	NE	SW	NW	N	W	SW	NE
-Speed (mph)	5	53	64	67	71	55	85	46	53	58	49	60	59	85
-Date		1987	1984	1986	1985	1985	1987	1987	1988	1988	1985	1988	1988	JUN 1987

(!!!) See Reference Notes on Page 68.

PRECIPITATION (inches)

LUBBOCK, TEXAS

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1959	0.08	0.07	T	1.28	2.15	7.25	1.30	0.72	0.89	0.98	0.02	1.47	16.21
1960	0.66	0.94	0.61	0.26	1.16	5.72	5.37	0.05	0.34	5.83	0.00	1.25	22.19
1961	0.56	2.51	1.34	0.10	2.05	4.03	4.06	1.78	0.18	0.55	1.31	0.35	18.82
1962	0.26	0.02	0.10	1.20	0.10	2.56	4.85	1.31	4.17	2.66	0.45	0.67	18.35
1963	0.06	0.54	0.73	0.25	6.79	2.10	0.37	2.67	0.78	0.59	1.13	0.20	16.21
1964	0.45	0.16	0.64	0.11	1.67	5.00	0.82	1.14	2.46	0.30	0.57	0.90	14.22
1965	0.08	0.35	0.22	0.41	1.63	1.44	2.14	0.62	5.68	1.06	0.02	0.50	14.15
1966	0.52	0.06	0.13	3.03	0.67	2.27	0.57	8.85	2.18	T	0.11	0.03	18.42
1967	0.00	0.14	2.09	0.95	3.45	7.95	3.29	0.71	0.98	0.45	0.11	0.52	20.64
1968	0.94	0.82	2.77	0.58	2.01	1.81	3.14	2.72	0.67	0.81	2.67	0.48	19.42
1969	T	1.13	1.77	1.14	3.88	1.41	2.99	2.59	4.93	7.76	0.77	0.82	29.19
1970	T	0.11	2.15	0.26	4.30	1.36	T	1.18	1.80	1.34	0.05	0.08	12.63
1971	T	0.81	0.21	1.36	2.44	2.25	0.76	4.15	5.22	1.79	0.43	0.81	20.23
1972	0.16	0.13	T	0.35	3.20	5.37	4.47	5.40	2.95	1.75	0.97	0.32	25.07
1973	1.44	1.26	1.90	1.40	0.43	0.32	4.16	0.36	0.73	0.89	T	T	12.89
1974	0.08	0.01	1.56	0.82	1.23	1.11	2.22	5.14	5.62	3.89	0.89	0.44	24.01
1975	0.41	1.53	0.04	0.45	2.74	1.80	4.32	2.21	2.61	0.06	1.18	0.34	17.69
1976	T	0.03	0.24	1.76	1.19	2.46	7.20	1.99	3.28	1.39	0.56	0.01	20.11
1977	0.24	0.38	0.82	2.90	2.46	2.28	1.13	4.31	0.49	1.11	0.02	0.01	16.15
1978	0.59	1.39	0.23	0.21	3.20	1.93	0.15	0.34	3.29	1.06	1.11	0.17	13.67
1979	0.33	0.85	2.95	1.17	4.00	3.69	1.84	3.81	0.21	0.59	0.09	1.29	20.82
1980	0.54	0.38	0.19	1.13	3.46	1.78	0.20	1.64	3.55	0.19	2.29	0.51	15.86
1981	0.32	0.67	1.19	2.05	1.25	0.79	3.35	5.41	1.78	5.34	0.64	0.20	22.99
1982	0.05	0.39	0.44	2.53	4.54	4.99	2.08	1.08	1.29	0.48	1.18	1.95	21.00
1983	2.75	0.32	0.55	0.77	1.23	1.79	0.41	0.32	0.39	10.80	0.54	0.36	20.23
1984	0.03	0.17	0.23	0.23	0.45	4.32	0.53	3.72	0.15	1.74	1.87	1.18	14.62
1985	0.38	0.27	1.19	0.48	2.97	4.51	3.94	0.63	4.73	3.60	0.27	0.18	23.15
1986	0.00	0.94	0.39	0.72	1.82	4.92	1.41	3.60	6.90	2.89	1.73	1.29	26.61
1987	0.54	1.47	0.41	0.09	3.30	2.40	4.29	1.68	2.67	0.77	0.11	1.09	18.82
1988	0.22	0.45	0.79	1.08	2.64	1.03	2.93	0.92	2.29	0.02	0.19	0.56	13.12
Record Mean	0.50	0.56	0.80	1.06	2.78	2.81	2.29	2.09	2.19	1.97	0.61	0.49	18.17

See Reference Notes on Page 68.

AVERAGE TEMPERATURE (deg. F)

LUBBOCK, TEXAS

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1959	37.9	42.5	49.0	58.6	70.3	76.6	77.2	79.2	72.9	58.4	44.4	42.3	59.1
1960	37.5	36.0	45.9	62.1	68.9	78.7	77.7	78.9	72.5	62.1	50.8	36.6	59.0
1961	35.6	41.5	50.5	60.3	69.5	75.0	76.3	76.0	69.9	61.2	44.7	39.3	58.3
1962	34.4	48.4	47.6	60.4	74.6	74.8	78.7	78.2	70.8	62.7	50.5	42.4	60.3
1963	32.8	42.5	53.0	64.3	70.5	76.2	81.9	79.0	72.9	65.8	50.7	36.7	60.5
1964	38.8	36.5	49.2	61.5	71.3	76.7	82.0	79.9	70.9	62.1	50.5	42.8	60.2
#1965	44.3	40.4	42.8	63.6	71.1	77.5	81.7	78.0	72.9	63.5	57.3	47.0	61.7
1966	34.2	40.5	55.7	60.4	69.8	78.5	85.4	76.8	71.6	60.9	55.6	38.0	60.6
1967	40.7	41.5	55.8	64.1	66.0	75.2	77.0	74.9	68.6	60.5	49.3	36.8	59.2
1968	40.7	38.5	48.5	55.3	65.5	74.5	75.3	74.2	66.7	61.9	46.6	39.9	57.3
1969	44.9	43.3	41.5	61.8	68.4	76.9	83.3	79.6	70.2	56.4	48.6	43.1	59.9
1970	37.5	45.5	46.2	58.5	68.7	75.7	80.8	79.0	71.5	56.7	48.7	45.1	59.5
1971	41.4	42.7	51.0	59.7	68.8	78.4	80.0	73.4	70.4	61.9	50.8	43.7	60.2
1972	41.3	45.9	56.3	65.7	67.4	76.9	76.5	74.4	71.0	59.6	42.4	38.0	59.6
1973	34.9	40.2	51.4	55.1	67.8	76.9	77.3	77.7	70.3	63.9	53.5	42.2	59.3
1974	41.3	45.6	58.5	63.1	75.1	78.6	80.6	74.4	64.0	59.9	48.1	40.6	60.8
1975	40.8	41.0	49.5	58.7	67.6	77.4	75.4	77.5	67.5	62.5	50.3	42.8	59.2
1976	39.6	51.2	52.1	62.4	66.0	77.1	75.0	77.9	70.0	54.1	42.6	40.3	59.0
1977	34.5	46.2	51.9	60.4	71.8	79.3	80.3	79.5	77.4	63.3	52.3	45.0	61.8
1978	32.1	33.9	51.7	65.1	70.1	79.0	82.9	78.2	72.0	62.1	49.9	38.1	59.6
1979	31.7	41.9	52.9	61.8	69.2	76.7	81.8	77.4	73.2	64.6	45.7	42.5	59.9
1980	40.3	44.3	50.8	59.0	68.7	83.1	84.3	80.6	73.0	60.2	46.0	45.7	61.3
1981	41.7	44.7	51.3	64.0	68.1	79.6	81.7	76.2	70.5	59.7	53.4	44.0	61.2
1982	39.7	42.4	53.7	59.3	67.8	73.5	80.1	81.0	74.4	60.6	48.6	38.3	60.0
1983	32.5	42.8	51.0	54.8	65.9	74.0	80.6	80.4	74.7	63.6	52.4	31.7	58.7
1984	37.9	45.3	49.4	58.0	71.2	76.9	78.3	78.2	69.3	59.5	49.5	43.9	59.8
1985	35.6	41.9	52.3	63.0	70.0	75.5	79.7	81.5	71.4	61.2	49.8	38.0	60.0
1986	44.4	45.6	56.5	64.2	69.9	75.9	81.9	77.6	71.5	59.7	47.0	40.5	61.2
1987	38.2	44.9	48.1	58.9	68.8	76.1	79.5	79.4	70.9	63.1	49.8	39.6	59.8
1988	36.3	42.8	50.1	59.9	68.8	78.0	79.3	79.7	71.4	62.9	51.9	41.9	60.3
Record Mean	38.5	42.8	50.2	60.3	68.8	77.3	79.8	78.2	71.2	61.2	48.7	41.2	59.9
Max	52.5	57.3	65.1	74.8	82.6	90.5	92.0	90.4	83.6	74.7	62.5	54.9	73.4
Min	24.4	28.3	35.3	45.7	55.1	64.1	67.6	65.9	58.8	47.7	34.9	27.4	46.3

See Reference Notes on Page 68.

HEATING DEGREE DAYS Base 65 deg. F

LUBBOCK, TEXAS

SEASON	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	TOTAL
1959-60	0	0	31	223	609	695	846	833	589	142	57	0	4025
1960-61	0	0	8	135	421	872	906	653	444	210	30	5	3684
1961-62	0	0	24	150	602	790	942	457	535	176	13	3	3692
1962-63	0	0	18	143	428	692	988	627	378	92	36	0	3402
1963-64	0	0	11	27	425	872	808	821	483	139	13	4	3603
1964-65	0	0	35	111	433	677	635	683	682	107	12	0	3375
# 1965-66	0	0	22	94	235	551	946	677	307	166	48	0	3046
1966-67	0	8	3	170	283	827	748	652	289	85	84	3	3152
1967-68	0	4	17	190	463	866	748	762	507	293	73	4	3927
1968-69	0	1	31	151	543	770	614	601	723	126	45	7	3612
1969-70	0	0	3	312	486	673	846	539	577	198	47	21	3702
1970-71	0	0	50	286	484	608	723	618	438	186	30	0	3423
1971-72	0	0	83	124	421	656	728	549	275	94	40	0	2970
1972-73	2	0	23	220	672	831	928	688	416	312	58	0	4150
1973-74	0	0	31	99	340	703	726	536	223	127	11	0	2796
1974-75	0	0	105	166	500	753	744	664	474	233	18	4	3661
1975-76	0	0	76	122	436	680	780	397	392	116	57	0	3056
1976-77	0	0	30	333	665	760	939	520	397	153	11	0	3798
1977-78	0	0	0	80	373	611	1014	864	419	75	64	0	3500
1978-79	0	0	31	129	447	827	1023	640	369	134	45	9	3654
1979-80	0	0	9	104	570	690	756	592	436	205	48	0	3410
1980-81	0	0	21	190	565	590	712	563	420	108	33	0	3202
1981-82	0	0	16	202	341	643	777	635	351	198	45	2	3210
1982-83	0	0	0	189	485	821	1001	613	430	326	68	13	3946
1983-84	0	0	18	107	371	1025	836	566	477	216	20	0	3636
1984-85	0	0	80	194	460	646	908	639	392	104	26	3	3452
1985-86	0	0	65	133	448	832	631	540	272	100	32	0	3053
1986-87	0	0	7	185	535	752	822	555	519	224	25	0	3624
1987-88	0	0	2	96	456	784	881	638	459	168	32	0	3516
1988-89	0	6	11	95	388	707							

See Reference Notes on Page 6B.
Page 5A

COOLING DEGREE DAYS Base 65 deg. F

LUBBOCK, TEXAS

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
1969	0	0	0	36	160	370	575	461	165	56	0	0	1823
1970	0	0	0	11	167	348	498	440	249	32	0	0	1747
1971	0	0	14	35	157	408	476	269	252	34	0	0	1645
1972	0	0	14	120	119	362	366	297	211	63	0	0	1552
1973	0	0	0	19	153	354	387	401	197	71	2	0	1594
1974	0	0	30	78	330	413	491	300	80	18	0	0	1740
1975	0	0	0	49	107	383	332	392	155	49	0	0	1467
1976	0	1	0	45	93	359	317	406	187	4	0	0	1412
1977	0	0	0	19	221	435	482	455	379	36	0	0	2027
1978	0	0	12	85	230	426	562	417	248	46	0	0	2026
1979	0	0	0	44	183	371	524	394	264	98	0	0	1878
1980	0	0	0	32	172	549	605	488	272	48	0	0	2166
1981	0	0	3	84	137	443	524	356	187	42	0	0	1776
1982	0	5	11	34	141	255	476	504	289	58	0	0	1773
1983	0	0	2	27	101	291	490	486	313	70	0	2	1782
1984	0	0	0	13	219	363	420	416	217	30	1	0	1679
1985	0	0	6	52	187	324	462	518	264	22	0	0	1835
1986	0	3	15	79	190	334	528	400	209	26	0	0	1784
1987	0	0	0	48	149	338	456	452	187	44	7	0	1681
1988	0	0	6	24	158	394	450	467	210	37	3	0	1749

See Reference Notes on Page 6B.
Page 5B

SNOWFALL (inches)

LUBBOCK, TEXAS

SEASON	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	TOTAL
1959-60	0.0	0.0	0.0	0.0	T	T	3.6	9.8	0.2	0.0	0.0	0.0	13.6
1960-61	0.0	0.0	0.0	0.0	0.0	9.9	3.9	13.7	6.9	T	0.0	0.0	34.4
1961-62	0.0	0.0	0.0	0.0	0.5	0.7	0.3	T	0.1	0.0	0.0	0.0	1.6
1962-63	0.0	0.0	0.0	0.0	T	1.4	2.3	8.0	T	0.0	0.0	0.0	11.7
1963-64	0.0	0.0	0.0	0.0	1.5	0.0	T	3.3	0.2	0.0	0.0	0.0	5.0
1964-65	0.0	0.0	0.0	0.0	0.0	0.1	0.2	2.0	1.2	0.0	0.0	0.0	3.5
1965-66	0.0	0.0	0.0	0.0	0.0	0.7	4.9	0.4	0.0	0.0	0.0	0.0	6.0
1966-67	0.0	0.0	0.0	0.0	T	T	0.0	0.7	T	0.0	0.0	0.0	0.7
1967-68	0.0	0.0	0.0	0.2	T	3.0	0.2	3.8	9.7	0.0	0.0	0.0	16.9
1968-69	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.1	11.7	0.0	0.0	0.0	13.6
1969-70	0.0	0.0	0.0	0.0	3.0	4.8	T	0.4	6.2	0.0	0.0	0.0	14.4
1970-71	0.0	0.0	0.0	0.0	0.1	0.0	T	5.2	2.1	0.0	0.0	0.0	7.4
1971-72	0.0	0.0	0.0	0.0	T	6.5	2.2	1.0	T	0.0	0.0	0.0	9.7
1972-73	0.0	0.0	0.0	T	5.9	0.4	9.4	9.6	T	0.3	0.0	0.0	25.6
1973-74	0.0	0.0	0.0	0.0	T	T	T	0.2	T	0.0	0.0	0.0	0.2
1974-75	0.0	0.0	0.0	0.0	0.0	1.1	1.7	3.8	0.7	T	0.0	0.0	7.3
1975-76	0.0	0.0	0.0	0.0	0.0	3.4	T	T	T	0.0	0.0	0.0	3.4
1976-77	0.0	0.0	0.0	7.5	9.1	0.1	2.0	1.7	T	0.0	0.0	0.0	20.4
1977-78	0.0	0.0	0.0	0.0	T	T	5.7	10.2	0.7	0.0	0.0	0.0	16.6
1978-79	0.0	0.0	0.0	0.0	0.5	1.7	0.8	8.6	0.6	0.0	0.0	0.0	12.2
1979-80	0.0	0.0	0.0	0.0	0.1	5.0	3.6	2.9	T	1.4	0.0	0.0	13.0
1980-81	0.0	0.0	0.0	0.0	21.4	T	3.5	0.1	T	0.0	0.0	0.0	25.0
1981-82	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.7	T	0.0	0.0	0.0	3.2
1982-83	0.0	0.0	0.0	0.0	0.4	6.8	25.3	3.4	T	5.3	0.0	0.0	41.2
1983-84	0.0	0.0	0.0	0.0	0.0	2.3	0.5	1.7	T	0.0	0.0	0.0	4.5
1984-85	0.0	0.0	0.0	0.0	T	0.1	2.0	T	T	0.0	0.0	0.0	2.1
1985-86	0.0	0.0	0.0	0.0	0.0	1.7	0.0	6.7	0.0	0.0	0.0	0.0	8.4
1986-87	0.0	0.0	0.0	T	T	5.8	4.9	3.3	1.3	0.1	0.0	0.0	15.4
1987-88	0.0	0.0	0.0	0.0	T	4.3	0.9	4.7	0.4	T	0.0	0.0	10.3
1988-89	0.0	0.0	0.0	0.0	1.4	3.6							
Record Mean	0.0	0.0	0.0	0.2	1.2	1.9	2.5	3.2	1.5	0.2	0.0	0.0	10.7

See Peference Notes on Page 6B.

REFERENCE NOTES

LUBBOCK, TEXAS

GENERAL

T - TRACE AMOUNT.
BLANK ENTRIES DENOTE MISSING/UNREPORTED DATA.
# INDICATES A STATION OR INSTRUMENT RELOCATION.
SEE STATION LOCATION TABLE ON PAGE 8.

SPECIFIC

PAGE 2
PM - INCLUDES LAST DAY OF PREVIOUS MONTH

PAGE 3
(a) - LENGTH OF RECORD IN YEARS, ALTHOUGH INDIVIDUAL MONTHS MAY BE MISSING.
* LESS THAN .05
NORMALS - BASED ON THE 1951-1980 RECORD PERIOD.
EXTREMES - DATES ARE THE MOST RECENT OCCURRENCE
WIND DIR.- NUMERALS SHOW TENS OF DEGRESS CLOCKWISE FROM TRUE NORTH. "00" INDICATES CALM.
RESULTANT DIRECTIONS ARE GIVEN TO WHOLE DEGREES.

PAGE 4B
MAX AND MIN ARE LONG TERM MEAN DAILY MAXIMUM AND MEAN DAILY MINIMUM TEMPERATURES.

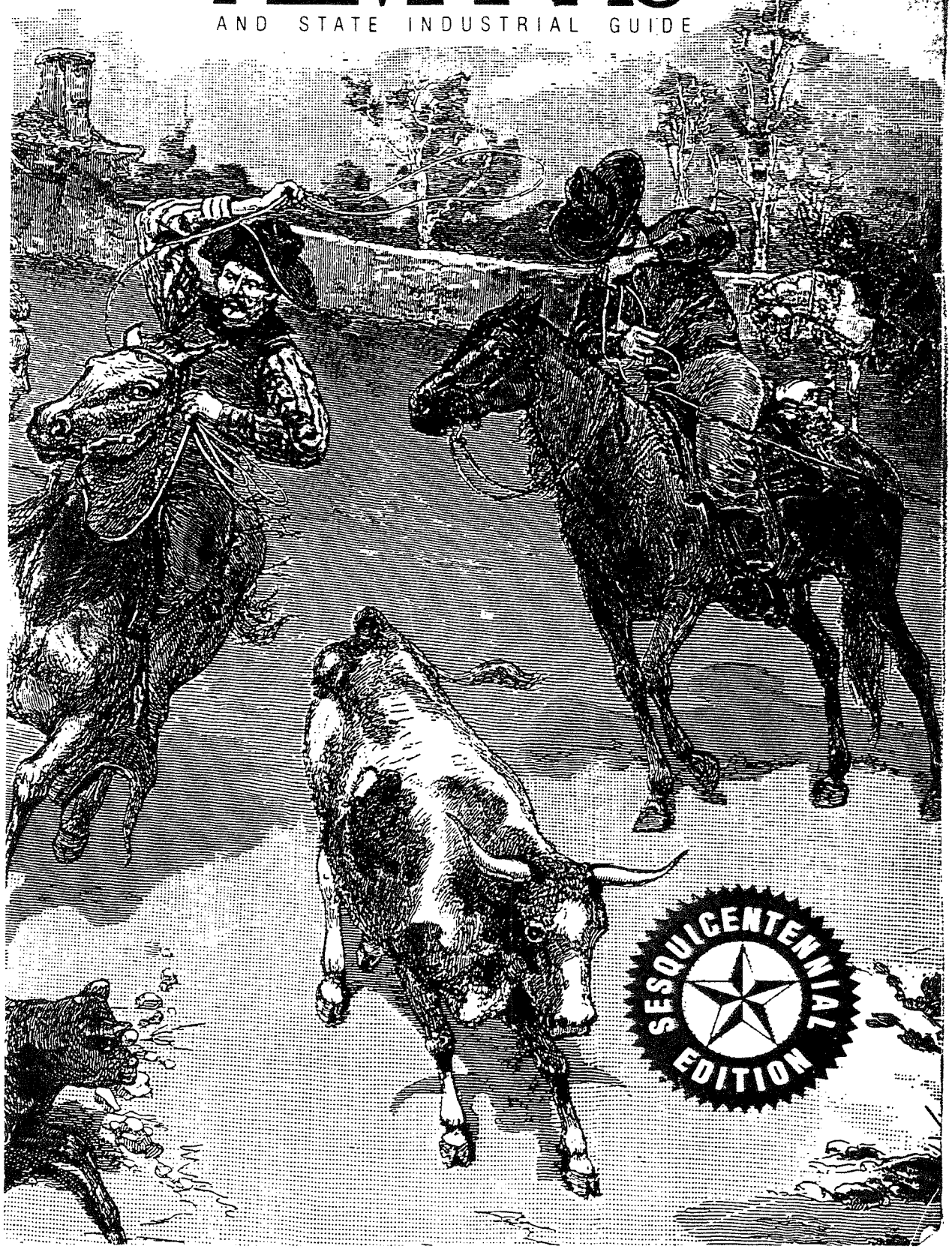
EXCEPTIONS

PAGES 4A, 4B, 6A
RECORD MEANS ARE THROUGH THE CURRENT YEAR, BEGINNING IN 1947 FOR TEMPERATURE
1947 FOR PRECIPITATION
1949 FOR SNOWFALL

1986 TEXAS 1987

ALMANAC

AND STATE INDUSTRIAL GUIDE



SESQUICENTENNIAL EDITION

Ground-Water Supplies and Use

Aquifers underlie more than half of the area of Texas. This ground water has long been the principal source of municipal supplies, but cities now increasingly depend upon surface reservoirs due to depletion of water in aquifer storage. More than half of Texas' total agricultural crop value is produced utilizing ground water for irrigation, mainly from the High Plains (Ogallala) aquifer on the High Plains.

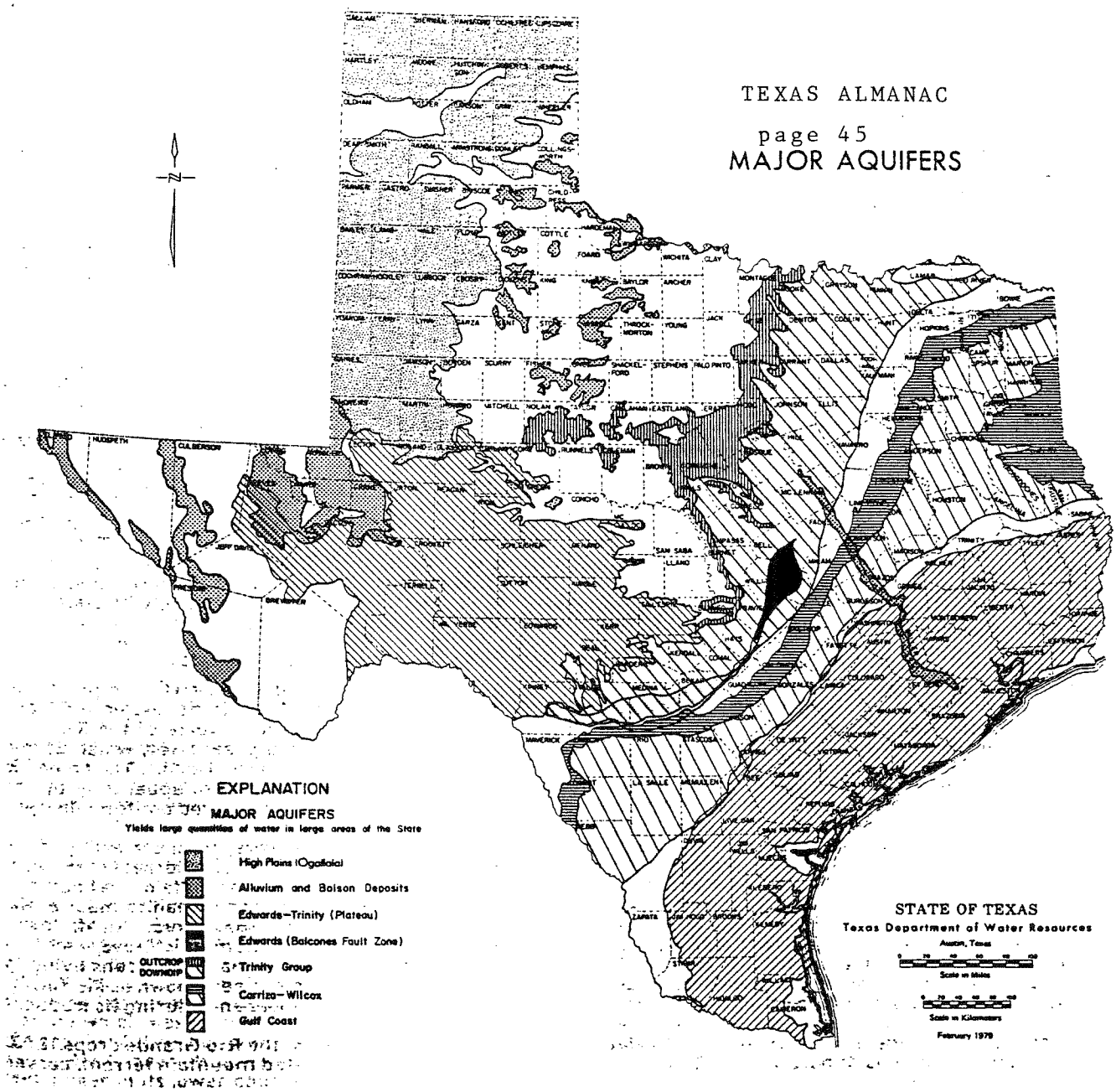
Declining water levels, mining and exhaustion of ground water, coupled with increasing energy costs, are major problems facing the state's water managers today.

Major aquifers in Texas follow (see map):

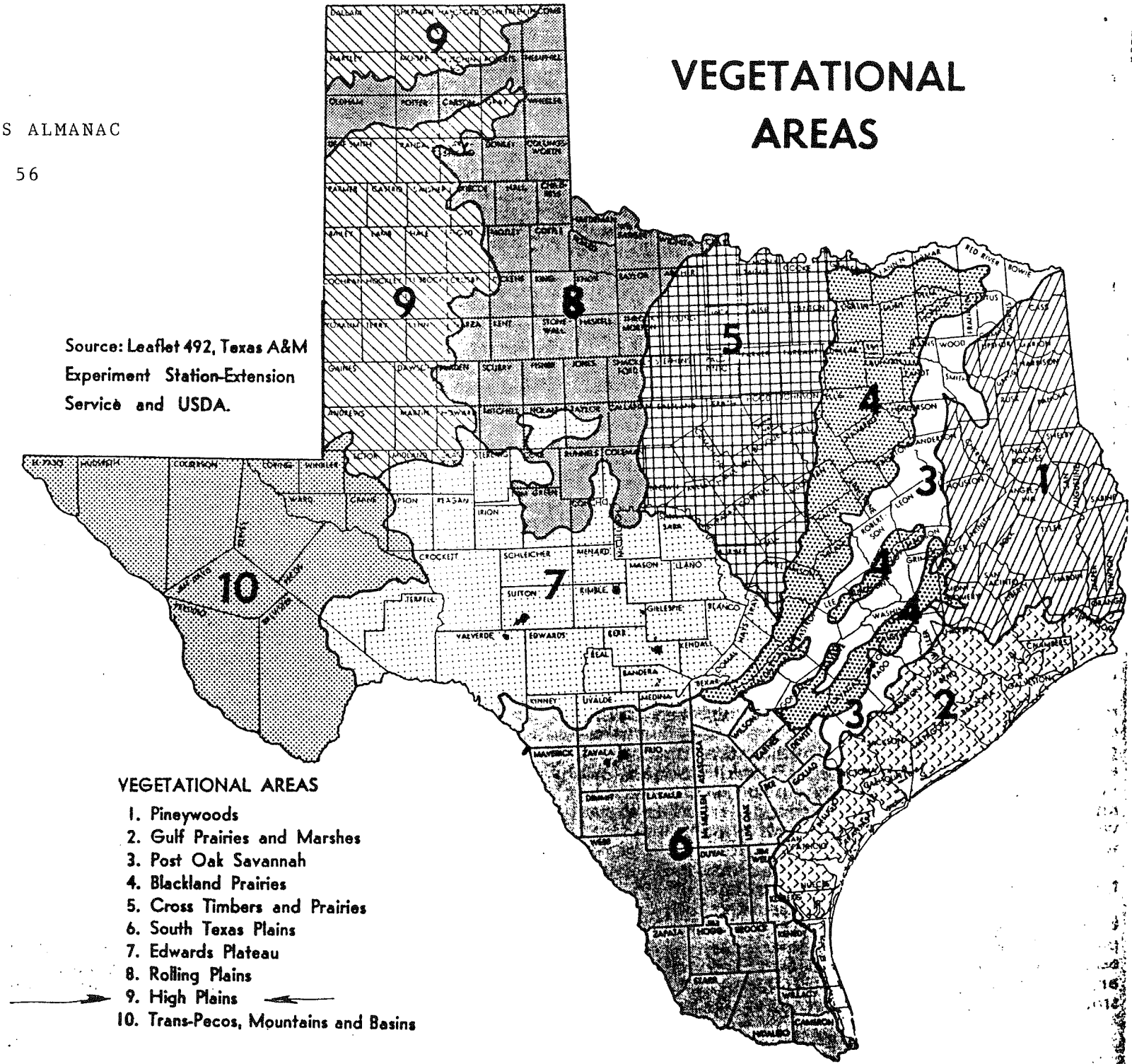
High Plains (Ogallala) — This formation furnishes practically the only usable quality water on the High Plains. It is composed of unconsolidated, fine- to coarse-grained, gray to red sand, clay, silt and gravel. Effective recharge from precipitation is small, averaging less than one-quarter inch yearly; whereas pumping is heavy, averaging about five million acre-feet yearly. Depletion at the present pumping rate threatens this as a water source for irrigation. The High Plains aquifer supplies Texas' largest irrigated farming region, which produces most of the cotton, grain sorghum and other crops.

Alluvium and Bolson Deposits — These water-bearing deposits are scattered throughout many areas in the state. They include the **Hueco and Mesilla Bolsons**, the **Cenozoic Alluvium** of West Texas, the alluviums of North Central Texas, the **Leona Alluvium** of Tom Green County and the **Brazos River Alluvium** of Southeast Texas. These deposits consist generally of sand, gravel, silt and clay. The quality of the water can range from fresh to saline.

In the westernmost Texas region, the Mesilla and Hueco Bolsons are the primary source of water supply for the **El Paso area** where serious problems exist regarding ground-water depletion and quality degradation. Other sources of ground-water supply are from the **Salt Bolson (Wildhorse Draw, Michigan Flat, Lobo Flat** and **Ryan Flat** areas), the **Red Light Draw Bolson**, the



VEGETATIONAL AREAS

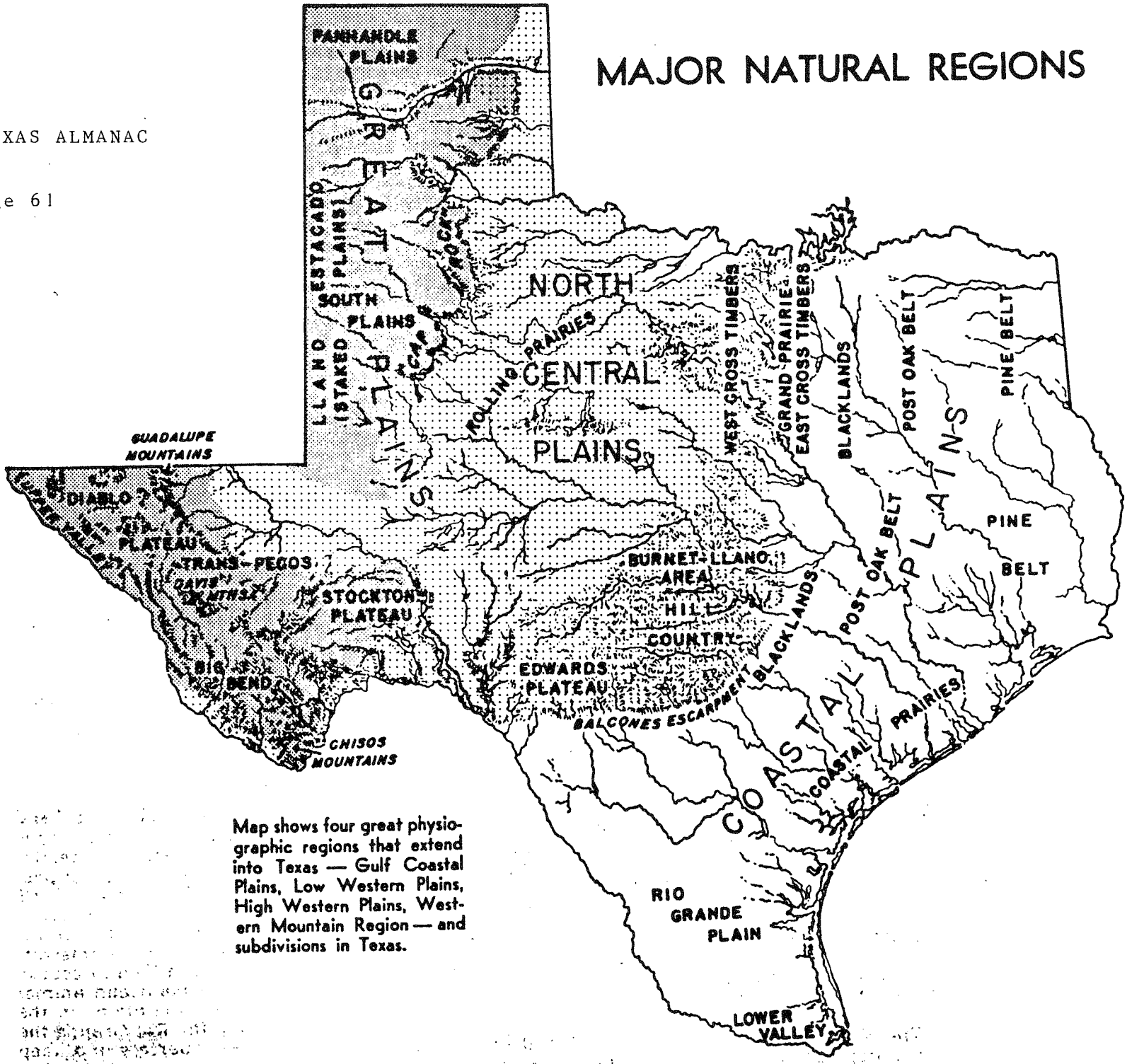


Source: Leaflet 492, Texas A&M Experiment Station-Extension Service and USDA.

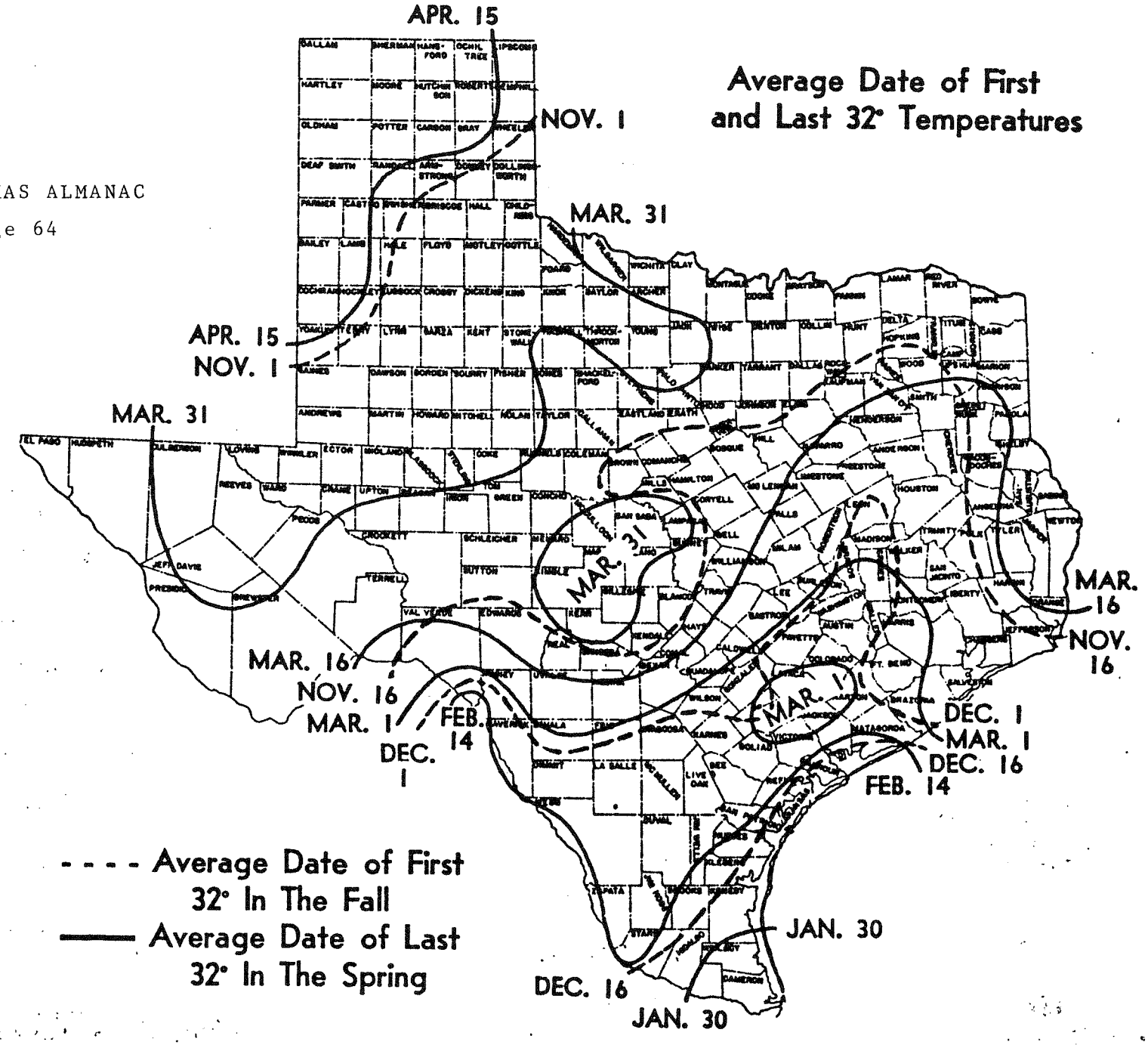
VEGETATIONAL AREAS

1. Pineywoods
2. Gulf Prairies and Marshes
3. Post Oak Savannah
4. Blackland Prairies
5. Cross Timbers and Prairies
6. South Texas Plains
7. Edwards Plateau
8. Rolling Plains
9. High Plains
10. Trans-Pecos, Mountains and Basins

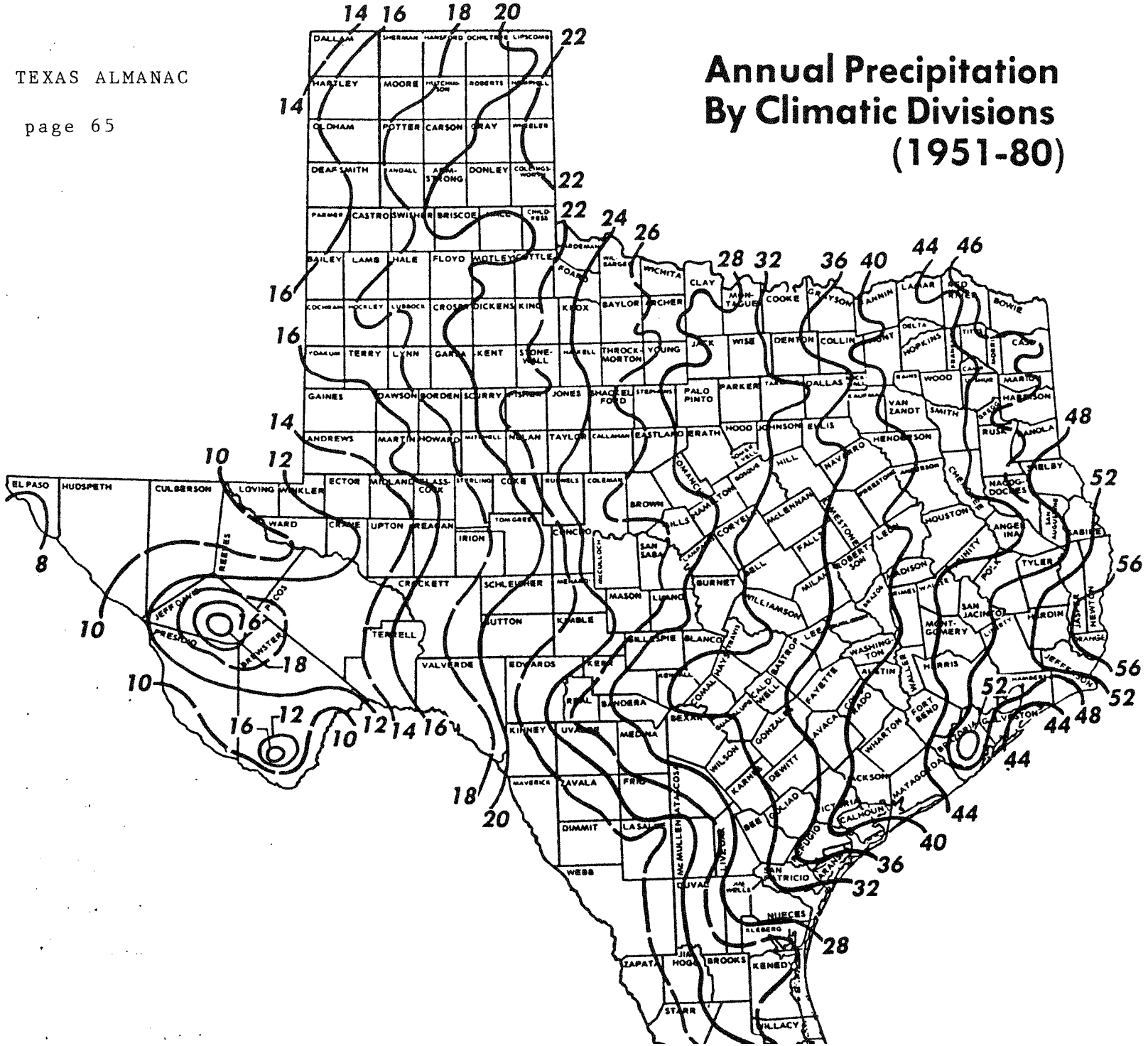
MAJOR NATURAL REGIONS



Map shows four great physiographic regions that extend into Texas — Gulf Coastal Plains, Low Western Plains, High Western Plains, Western Mountain Region — and subdivisions in Texas.


Average Date of First and Last 32° Temperatures
APR. 15
NOV. 1
MAR. 31
APR. 15
NOV. 1
MAR. 31
MAR. 31
MAR. 16
NOV. 16
MAR. 16
NOV. 16
MAR. 1
FEB. 14
DEC. 1
DEC. 1
MAR. 1
DEC. 16
FEB. 14
JAN. 30
DEC. 16
JAN. 30
---- Average Date of First 32° In The Fall
—— Average Date of Last 32° In The Spring

Annual Precipitation By Climatic Divisions (1951-80)



METEOROLOGICAL DATA

Source: NOAA, Environmental Data Service, Local Climatological Data.

Additional data for these locations are listed in the table of Texas temperature, freeze, growing season, and precipitation records, by counties.

	Temperature						Precipitation					Relative Humidity		Wind			Per Cent Possible Sunshine
	Record Highest	Month and Yr.	Record Lowest	Month and Yr.	No. Days Max. 90° and Above	No. Days Min. 32° and Below	Maximum in 24 Hours	Month and Year		Max. Snowfall in 24 Hours	Month and Year	6:00 A.M. CST	Noon CST	Speed, MPH Mean Annual	Highest Miles Per Hour	Month and Year	
Abilene	111	8-43	—9	1-47	96	55	6.78	5-08	4.3	8.0	†1-19	74	50	12.2	109	6-51	71
Amarillo	108	6-53	—16	2-99	65	110	6.75	5-51	13.9	20.6	3-34	72	45	13.7	84	5-49	73
Austin	109	†7-54	—2	1-49	104	23	19.03	9-21	1.2	9.7	11-37	83	56	9.3	57	2-47	61
Brownsville	106	3-84	12	2-99	117	2	12.19	9-67	‡‡	‡‡	†11-76	88	60	11.6	106	9-33	61
Corpus Christi	105	7-34	11	2-99	102	7	8.92	8-80	0.1	5.0	1-97	90	63	12.0	161	8-70	63
Dallas-Fort Worth	113	6-80	—8	†2-99	95	41	9.57	9-32	2.9	12.1	1-64	82	56	10.8	77	7-36	66
Del Rio	111	†7-60	11	2-51	125	18	8.88	6-35	0.8	4.7	1-26	79	54	9.9	62	3-35	70
El Paso	112	7-79	—8	1-62	106	62	6.50	7-1881	4.4	8.4	11-06	55	35	9.2	70	†5-50	83
Galveston	101	7-32	8	2-99	12	4	14.35	7-00	0.2	15.4	2-95	83	72	11.0	*100	9-00	63
***Houston	108	8-09	5	†1-40	92	24	15.65	8-45	0.4	4.4	2-60	91	60	7.8	84	3-26	56
Lubbock	109	†7-40	—17	2-33	79	96	5.82	10-83	8.8	16.3	1-83	74	46	12.5	70	5-52	73
Midland-Odessa	109	6-51	—11	2-33	97	63	5.99	7-61	3.4	6.8	1-74	73	42	11.1	67	2-60	75
Prt. Arthur-Beaumont	107	8-62	11	1-30	82	17	17.76	7-43	0.5	††20.0	2-95	91	64	10.0	91	8-40	58
San Angelo	111	†7-60	—1	12-83	108	53	11.75	9-36	3.0	7.4	1-78	78	49	10.5	75	4-69	70
San Antonio	107	8-09	0	1-49	111	23	7.28	9-73	0.5	5.0	1-40	83	55	9.4	74	8-42	60
Victoria	110	7-39	9	1-30	102	13	9.30	6-77	‡‡	1.2	1-73	89	60	10.0	§150	9-61	62
Waco	112	8-69	—5	1-49	106	35	7.18	5-53	1.5	7.0	1-49	83	57	11.3	69	6-61	63
Wichita Falls	117	6-80	—12	1-47	107	69	6.22	9-80	5.7	5.9	1-66	82	51	11.7	92	6-45	68
**Shreveport, La.	110	8-09	—5	2-99	88	37	7.17	4-53	1.3	5.6	1-82	87	58	8.6	52	4-75	63

*100 mph recorded at 6:15 p.m. Sept. 8 just before anemometer blew away. Maximum velocity estimated 120 mph from NE between 7:30 p.m. and 8:30 p.m.

†Also recorded on earlier dates, months or years.

‡Anemometer damaged.

§Highest sustained wind estimated 110 mph. Highest gust estimated 150 mph at 5:55 p.m., Sept. 11, 1961.

**These stations are included because they are near the boundary line and their data can be considered representative of the eastern border of Texas.

††Measured at Orange, Texas, near Port Arthur.

‡‡Trace, an amount too small to measure.

***The official Houston station was moved from near downtown to Intercontinental Airport, located 12 miles north of the old station.

STAKED PLAINS OR LLANO ESTACADO

The Great High Plains which lie to the east of the base of the Rocky Mountains extend into Northwest Texas. This Texas area is known as the **Staked Plains** or the Spanish equivalent ***Llano Estacado.**

*Historians differ as to the origin of this name. Some think that it came from the fact that the Coronado expedition, crossing the trackless sea of grass, staked its route so that it would be guided on its return trip. Others think that the "estacado" refers to the palisaded appearance of the Cap Rock in many places, especially the west-facing escarpment in New Mexico.

The **Cap Rock Escarpment** is the dividing line between the High Plains and the Lower Rolling Plains of West Texas. Like the Balcones Escarpment, the Cap Rock Escarpment is an outstanding natural boundary line. Unlike the Balcones Escarpment, the Cap Rock Escarpment is caused by surface erosion. In many places this escarpment is a striking physical feature, rising abruptly 200, 500 and in some places almost 1,000 feet above the plains at its base. Where rivers issue from the eastern face of this escarpment there frequently are notable canyons such as the **Palo Duro Canyon** on the Prairie Dog Town Fork (main channel) of the Red River and the gorge along the Canadian as it crosses the Panhandle north of Amarillo.

Along the eastern edge of the Panhandle there is a gradual descent of the earth's surface from high to low plains, but at the Red River the Cap Rock Escarpment becomes a striking surface feature. It continues as an east-facing mountain wall south through Briscoe, Floyd, Motley, Dickens, Crosby, Garza and Borden Counties, gradually decreasing in elevation. South of Borden County the escarpment turns west to the vicinity of Winkler County, then turns north through the eastern part of New Mexico.

Stretching over the largest level plain of its kind in the United States, the Great High Plains rise gradually from about 2,700 feet on the east to more than 4,000 in spots along the New Mexico border.

Chiefly because of climate and the resultant agriculture, subdivisions are called the **North Plains** and **South Plains.** The North Plains, from Hale County north, has primarily wheat and grain sorghum farming, but with significant ranching and petroleum developments. Amarillo is the largest city, with Plainview, Borger and others as important commercial centers. The South Plains, also a leading grain sorghum region, leads Texas in cotton production. Lubbock is the principal city, and Lubbock County the state's largest cotton producer. Irrigation, centered around Lubbock and Plainview, from underground reservoirs, waters much of the crop acreage.

Edwards Plateau

2. HIGH PLAINS SOILS

The High Plains area comprises the vast high plateau of more than 19 million acres in Northwestern Texas. It lies in the southern part of the Great Plains province that includes large similar areas in Oklahoma and New Mexico. The flat, nearly level surface of very large areas has few streams of any dissection to cause local relief. However, several major rivers originate in the High Plains or cross the area. The largest is the Canadian River which has cut a deep valley across the Panhandle section.

Playas, small intermittent lakes scattered through the area, lie up to 20 feet below the surrounding flat plains. Early estimates were that playas numbered 37,000; a 1965 survey indicated more than 19,000 in 44 counties, occupying some 340,000 acres. They received most of the runoff, with less than 10 percent of this water percolating back to the aquifer. In 1969 there were only limited numbers being utilized for recharge wells to return water to aquifers.

Soils are brown to reddish, mostly deep, clay loams, sandy loams and sands. Free lime is present under many soils at various depths. Main series: Pullman, Olton, Sherm (hardlands); Amarillo, Portales (mixed lands); Brownfield, Tivoli (sandy lands); Potter (loamy soils, shallow over caliche). The Guadalupe, Spur and Bippus series are the main soils of bottomlands, but are minor in extent.

The soils are moderately productive and the flat surface encourages irrigation and mechanization. Limited rainfall and constant danger of wind erosion are handicaps; but the region is Texas' leading producer of three most important crops — cotton, grain sorghums and wheat.

The native vegetation is of three distinct kinds. In the northern part and on the fine-textured soils south of the Canadian River, the vegetation is short grasses, mainly **buffalo** with some **grama.** In the southern part on the sandy loam soils it is largely **grama** and **threeawn.** On the deep sands it is mainly **little bluestem, sand dropseed, sideoats grama** and **threeawn grasses.** In places these sands support a thick growth of **shinoak** and **sand sage** (Artemisia).

certain rangelands.

9. High Plains. The High Plains, some 20 million treeless acres, are an extension of the **Great Plains** to the north. The level nature and porous soils prevent drainage over wide areas. The relatively light rainfall flows into the numerous shallow "playa" lakes or sinks into the ground to feed the great underground aquifer that is the source of water for the countless wells that irrigate the surface of the plains. A large part of this area is under irrigated farming, but native grassland remains in about one half of the High Plains.

Blue grama and **buffalograss** comprise the principal vegetation on the clay and clay loam "hardland" soils. Important grasses on the sandy loam "sandy land" soils are **little bluestem, western wheatgrass, Indiangrass, switchgrass** and **sand reedgrass. Sand shinnery oak, sand sagebrush, mesquite** and **yucca** are conspicuous invading brushy plants.

(13)

TECHNICAL COMPLETION REPORT

IRRIGATION WATER MANAGEMENT FOR THE TEXAS HIGH PLAINS: A RESEARCH SUMMARY

Project Number G-1046-22
(May 17, 1985 - August 31, 1986)

Grant Number

14-08-0001-G-1046

by

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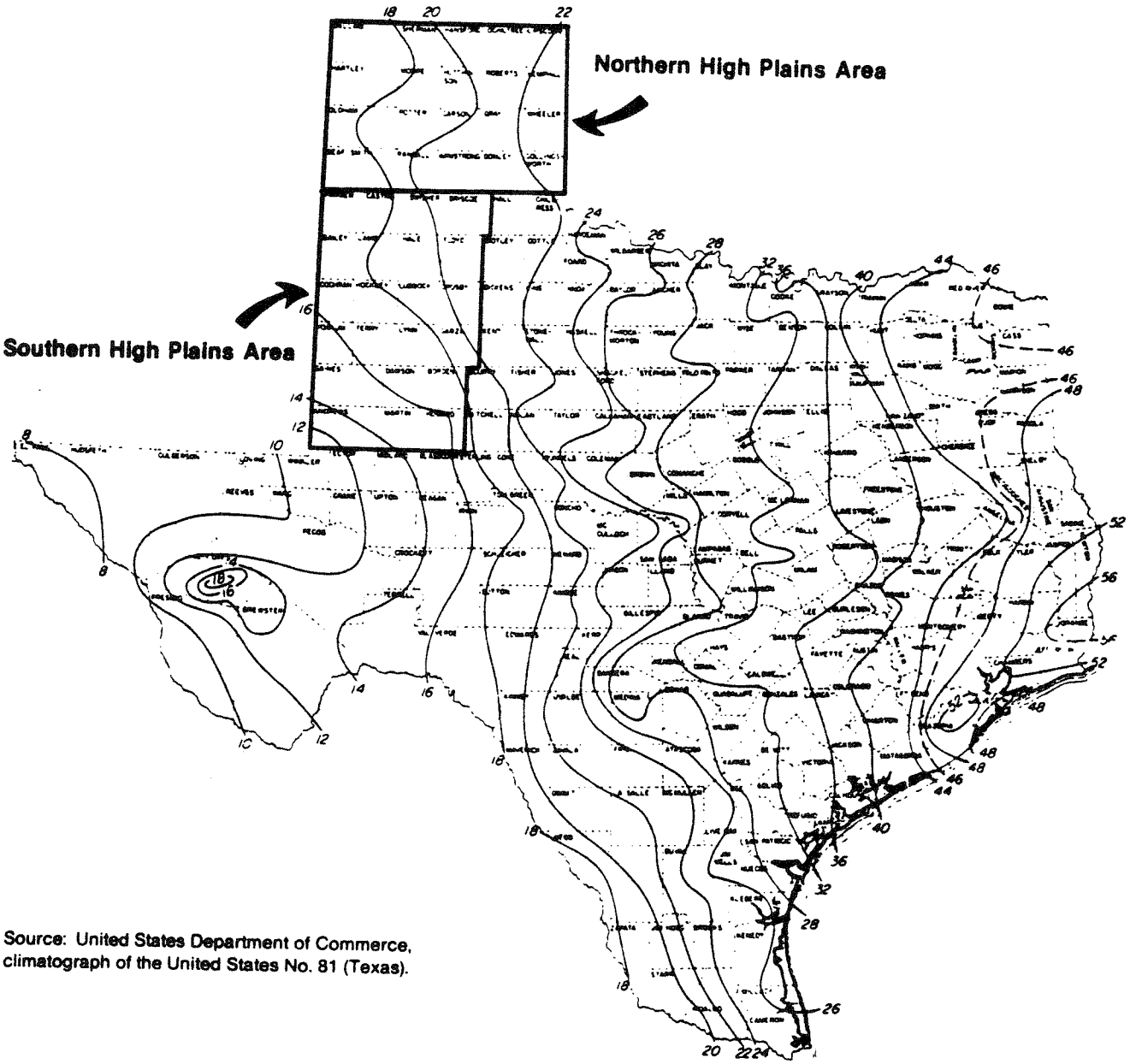
Description of Region

The High Plains of Texas covers about 35,000 square miles (90,000 km^2) at the southern end of the Great Plains. This semi-arid region includes the upper reaches of the Red, Brazos, and Colorado River basins (Forster, 1985) and is traversed by the Canadian River. The region comprises about 11% of the state's land area.

The High Plains of Texas sits at an elevation of 3,000-4,000 feet (900-1,200 m), and it contains approximately 10.8 million acres (4.4 million ha) of planted cropland and 10.4 million acres (4.2 million ha) of range and pastureland in 42 counties (Clarke, 1986). Annual rainfall ranges from 12 to 22 inches (300-560 mm) (Figure I-1) and the growing season lasts from 180-220 days. About 5 million acres (2 million ha) of the cropland is irrigated with groundwater from the Ogallala Aquifer. In addition, more than 3.5 million head of cattle were marketed annually from cattle feedlots on the Texas High Plains, and these feedlots are a major user of grain and cotton by-products from the region.

Rainfall Patterns

Average monthly precipitation for Lubbock and Amarillo for 1911-1985 is shown in Table I-1 (Carver et al., 1985). Approximately two-thirds of the annual precipitation occurs just before or during the summer growing season. However, large variations from the mean monthly rainfall are usually experienced, and actual conditions can range from arid to humid. The amount of precipitation exceeded in 75, 50 and 25% of the 104 years of record for Amarillo show large discrepancies between average and median values, and between the wettest and driest 25% of the years, as depicted in Figure I-2 (Stewart et al., 1984).



Source: United States Department of Commerce, climatograph of the United States No. 81 (Texas).

Figure I-1. Texas High Plains study region and mean annual precipitation for the region and the state (Clarke, 1986).

The maximum annual precipitation in the region usually approaches 200% of the average, and minimum precipitation is about 50% of the average (Stewart and Musick, 1982). More years have below-average than above-average rainfall. Drought years provide both less rain and higher evaporation than average years. An irrigation system designed assuming near-average rainfall will be unsatisfactory both in drought and wet years (Stewart and Musick, 1982).

Rainfall probabilities are more important than average rainfall as a basis for decision making in water management, especially for dryland farming where it is almost imperative to take advantage of favorable years. Rainfall occurring in amounts of less than one inch account for about two-thirds of the annual rainfall (Carver et al., 1985). For example 20-year rainfall data for Bushland showed that 95.2% of the rainfall events were less than 1.0 inches, and they yielded 65.8% of the total precipitation (Stewart et al., 1984), as shown in Figure I-3. The remaining precipitation occurs in 3 to 5 events per year with 1 to 5 inches (25-127 mm) of rainfall (Carver et al., 1985), and these events generally create some runoff. These small precipitation events are generally absorbed by the soil, although soil storage efficiency may be low due to evaporation in hot or windy conditions (Stewart et al., 1984). As shown in Figure I-4, periods of peak rainfall are similar to the periods of maximum solar radiation and air temperature in the region (Musick and Dusek, 1980). Tillage and cultural practices to increase soil moisture storage are important.

The Ogallala Aquifer

The Ogallala Aquifer which extends from Texas through Nebraska is the major component of the High Plains Aquifer, and underlies about 35,000 square miles (90,000 km^2) of the Texas High Plains (Knowles, 1985). Over 70,000 irrigation wells have been completed into this aquifer which also serves as the municipal water supply for many towns and most rural residents. Well yields are commonly 100 to 500 gallons per minute (6.3-31.5 L/s) (Schefter, 1984). Irrigation accounts for 95% of the total water used (Knowles, 1985). Total pumpage for irrigation reached a peak of 8.1 million acre-feet (10.0 km^3) in 1974 and declined to 5.6 million acre-feet (6.9 km^3) in 1979. The 1984 irrigation inventory showed pumpage at 5.0 million acre-feet (6.2 km^3).

Saturated thickness of the High Plains (Ogallala) Aquifer ranges from less than 50 feet to more than 300 feet (15-91 m) (TWDB, 1986). The thickness is primarily controlled by the topography before the Ogallala sediments were deposited and subsequently buried by later alluvial deposits (Knowles, 1985). The thicker sections are in the Northern High Plains and the thinner sections are in the Southern High Plains. The average saturated thickness is 112 feet (34 m) (Knowles, 1985). Regarding depth to water table, 30% of the water is within 100 feet (30 m) of the surface and 81% is within 400 feet (122 m).

The USGS has estimated that before significant irrigation development the High Plains Aquifer in Texas contained 3,230 million acre-feet (3990 km^3) of saturated material and 1,100 million acre-feet (1,360 km^3) of water assuming 40% porosity (Knowles, 1985). Specific yield is about 15%; hence, prior to development of irrigation, the total drainable water supply was around 500 million acre-feet (620 km^3). The drainable water was estimated at 505 million acre-feet (620 km^3) in 1960 and 420 million

acre-feet (520 km^3) in 1980, of which 91% was recoverable by wells. In comparison all the lakes and reservoirs in the state have a combined conservation storage of only 32 million acre-feet (39 km^3), or only one-thirteenth of the storage of the Ogallala Aquifer in Texas. According to Knowles (1985) water surface gradient averages 15 feet per mile (0.0028 m/m) to the east-southeast or east. Rate of water movement is about 7 inches (180 mm) per day, specific yield averages 16 percent, and the hydraulic conductivity averages 400 gallons per day per square foot (16 m/day). Jones and Schneider (1969) measured specific yield of the Ogallala Aquifer at Bushland and determined a value of 22 percent using a neutron meter versus 14% using pumping tests.

According to Reddell et al. (1985), porosity of the aquifer is about 40 percent, which is filled with water when saturated. However, only about 15 percent of the aquifer volume is available water (i.e. specific yield is 15 percent) while the other 25 percent (specific retention) is held by capillary forces and is not available for pumping. This means there is only 1.8 inches of available water per foot (150 mm/m) of saturated thickness.

According to USGS estimates, the aquifer in Texas has been depleted by almost 23 percent since irrigation was first developed. Nevertheless, water levels actually rose in a large portion of the Southern High Plains during recent years. Possible reasons may include reduced pumpage due to economics and conservation technology, infiltration of earlier irrigation waters, soil modifications and above-normal precipitation.

Earlier estimates of recharge were 0.2 inches (5 mm) per year or 372,000 acre-feet (0.46 km^3) per year. But according to Knowles (1985),

there is reason to believe that greater recharge could be occurring, a possibility that is currently being investigated.

The Texas Department of Water Resources developed a computer model of the aquifer and used it to project future conditions based on certain assumptions. Even with expected decreases in withdrawals, the volume of water stored in the Ogallala Aquifer in Texas would be decreased by 38 percent from 1980 to 2030, according to one set of projections (Knowles, 1985). Nevertheless, the aquifer could continue to supply substantial amounts of groundwater at least for several decades. The most significant reductions would occur in the southern part of the aquifer.

Decreased well yields are the result of lowered water levels because of and reduced aquifer transmission capacity. Well yields in the Southern Great Plains have generally decreased in relation to declining water levels according to an inverse square relationship (Hughes and Harman, 1969). Thus a 50 percent reduction in aquifer thickness would reduce well yields to only 25 percent of their initial capacities. Many wells have been retrofit with smaller pumping plants to match the smaller well yields.

Natural Recharge Rates

Natural recharge to the Ogallala Aquifer is believed to average only about 0.2 inches (5 mm) per year in Texas and New Mexico (Heath, 1984; Knowles, 1985) which is 1-2 percent of annual rainfall. The subsoil permeability is low in much of this region due to a caliche and/or hardpan layer and evapotranspiration is high, so that significant recharge occurs only during years of above normal rainfall (Heath, 1984). By contrast, the Nebraska Sand Hills portion of the Ogallala Aquifer experiences about a

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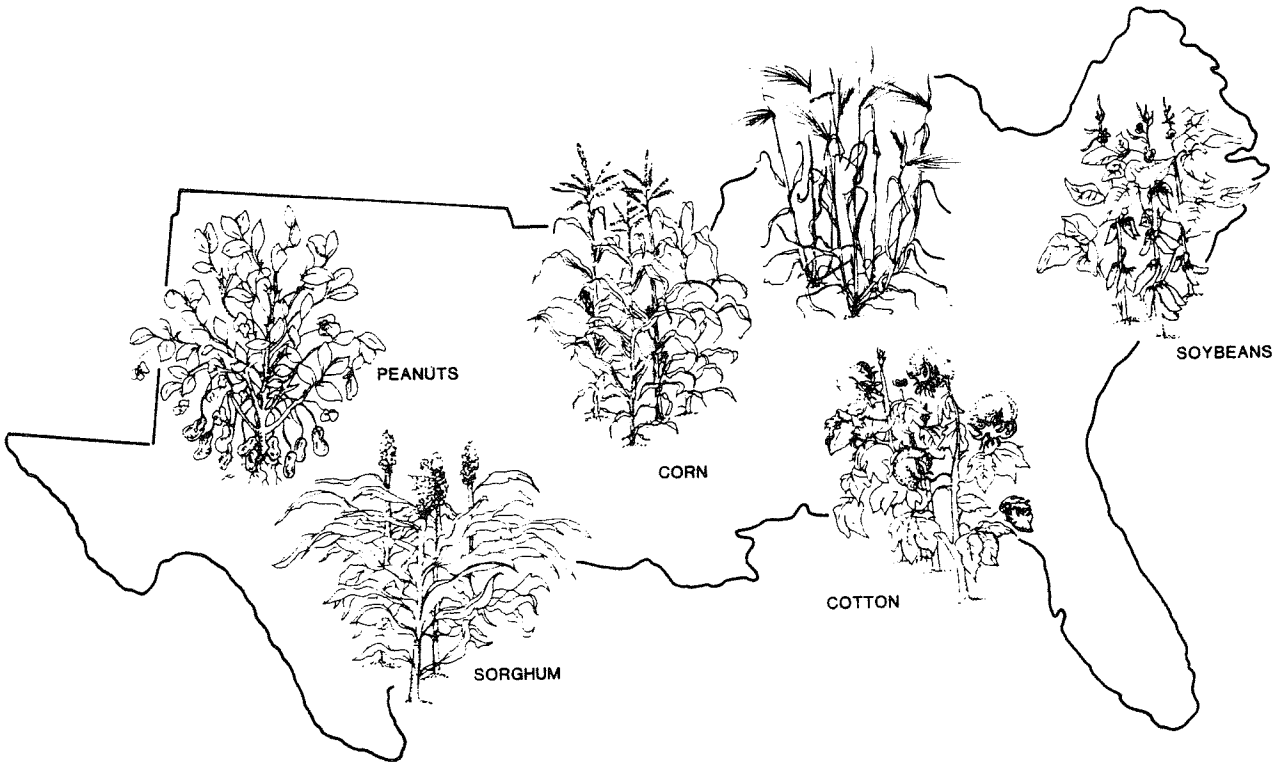
Conservation Tillage: Today and Tomorrow

Southern Region No-till Conference



Proceedings

July 1987
College Station, Texas

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, The Texas A&M University System, College Station, Texas

Proceedings of the Southern Region No-Tillage Conference

Conservation Tillage: Today and Tomorrow

July 1-2, 1987
College Station, Texas

Edited by

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1983 and before the CTIC was established, data collection and terminology were not uniformly defined. However, data collection since 1984 when the CTIC began operations has been fairly consistent.

Acreage of cropland planted in Texas has fluctuated during the past but has ranged from 20 million to 30 million acres (Table 1). Acreage of no-till production also has varied but has increased overall and now stands at about 270,000 acres. Acreages of ridge-till and strip-till in Texas have been variable and relatively minor at fewer than 90,000 acres. Mulch tillage and reduced tillage probably should be considered together since they are so closely related in Texas. The variation of these two in recent years in part reflects weather fluctuations and consequent production variations. In general, trends are for increases in use of mulch-tillage practices. More than 3.2 million acres are mulch-tilled.

Trends since 1974 show variations in acreage of conservation tillage from year to year but generally demonstrate increases in adoption during the early years at a rate of more than 200,000 acres per year. Expansion leveled off somewhat after 1980. New conservation regulations should spur another expansion of acreage.

Statewide data (Table 2) demonstrate that fall-seeded small grain is the predominant crop in conservation tillage systems in Texas, accounting for more than 2.2 million acres. Full-season grain sorghum and corn account for almost 670,000 and 310,000 acres, respectively. Other crops make up lesser acreages. Most of the small grain in conservation tillage is mulch-tilled, by far the largest of all categories. Small grain and permanent pasture make up the bulk of no-till acreages. Cotton and soybeans produced under conservation tillage systems are mostly grown with mulch- or reduced-tillage practices.

Cropping and Conservation Tillage Systems for Major Production Regions

A combination of Major Land Resource Areas and Texas Crop Reporting Districts was used to identify areas appropriate for discussions about specific types of tillage systems used in the state. Of the 22.8 million acres of croplands indicated in Table 1, the Major Crop Production Regions developed for this study and shown in Table 3 and Figure 1 represent 21.1 million acres. The other less extensive crop production regions are not included in these discussions.

Another source of data for these discussions is the Texas Agricultural Statistics Service (TASS), a division of the Texas Department of Agriculture, located at 300 E. Eighth Street, Room 555, Austin, Texas 78767. Some differences in total "cropland" between TASS and CTIC data are due to different statistical techniques for information gathering.

Below are discussions of conservation tillage systems for each major production region in Texas:

Northern High Plains

The Northern High Plains is made up predominantly of soils with clay loam surface horizons and clay-textured subsoils except for the extreme northwestern portion, which has sandy-textured soils. This mostly level to gently sloping region is subject to wind erosion in western sections and to water erosion along breaks into drainageways.

TASS describes this 23-county area of 15 million acres as having 5.3 million acres of cropland, of which corn (473,000 acres), irrigated cotton (430,000 acres), dryland cotton (121,000 acres), irrigated grain sorghum (520,000 acres), dryland grain sorghum (400,000 acres), soybeans (63,000 acres), irrigated wheat (848,000 acres), and

TABLE 1. EXTENT OF CONSERVATION TILLAGE IN TEXAS[1]

Production Year	Acres[2] Cropland	No Till	Ridge Till	Strip Till	Mulch[3] Till	Reduced Till	Consv.[4] Till
	Acres (1000)						
1974	23,500	109	—	—	1,101	—	1,210
1975	24,400	209	—	—	1,179	—	1,388
1976	26,702	209	—	—	2,121	—	2,330
1977	26,948	262	—	—	2,357	—	2,619
1978	23,436	147	—	—	1,501	—	1,648
1979	29,792	122	—	—	1,255	—	1,377
1980	27,483	125	—	—	3,500	—	3,625
1981	26,369	44	—	—	2,554	—	2,598
1982	29,469	45	—	—	3,154	—	3,199
1983	20,399	149	110	33	2,667	2,060	5,019
1984	24,583	336	9	12	1,178	1,320	2,855
1985	24,841	308	45	20	2,141	1,590	4,104
1986	22,819	269	67	20	3,201	219	3,776

[1]Data for 1982-1986 from Conservation Technology Information Center annual reports. Data for 1974-1981 from Soil Conservation Service estimates.

[2]Total cropland planted.

[3]Data for production years 1974-1982 involved compiling all conservation tillage practices except no-till in one category called Reduced/Minimum Tillage, here combined under "Mulch till" since that represents the most extensive practice by current definitions.

[4]Total conservation tillage acreage.

TABLE 2. INDIVIDUAL CROP ACREAGE BY CONSERVATION TILLAGE TYPES[1]

Crop category	Acres cropland	No Till	Ridge Till	Strip Till	Mulch Till	Reduced Till	Consv.* Till
Corn (FS)	1,723,039	6,417	6,590	850	239,154	57,140	310,151
Corn (DC)	57,763	2,000	0	0	5,920	0	7,920
Small Grain (SpSd)	378,333	1,489	0	0	15,476	16,455	33,420
Small Grain (FlSd)	7,921,153	165,272	3,700	10,750	2,052,063	0	2,231,785
Soybeans (FS)	334,317	3,850	1,000	350	23,700	5,075	33,975
Soybeans (DC)	15,397	1,350	0	0	1,250	0	2,600
Cotton	5,477,804	5,875	5,126	5,040	87,971	32,035	136,047
Grain Sorghum (FS)	4,986,814	24,606	6,820	2,753	528,011	107,068	669,258
Grain Sorghum (DC)	394,511	9,885	0	100	54,589	50	64,624
Forage Crops	271,932	2,735	0	0	58,207	0	60,942
–Permanent Pasture	436,476	70,961	0	0	111,721	0	182,682
Other Crops	1,258,380	45,880	43,439	200	134,323	1,000	224,842
–Fallow	1,492,708	38,332	0	0	172,707	677	211,716
–Conservation Use	4,479,299	0	0	0	0	0	0
Totals	22,819,443	269,359	66,675	20,043	3,200,664	218,823	3,775,564

[1]Taken from Conservation Technology Information Center, 1986 National Survey of Conservation Tillage Practices, Texas County Summary.
*Sum of no-till, ridge-till, strip-till, mulch-till, reduced-till
FS—Full Season; DC—Double Crop; SpSd—Spring Seeded; FlSd—Fall Seeded
Fallow includes cropland idled for the entire year
Conservation use includes cropland idled for set-aside or diverted acres
–Not included in totals

TABLE 3. CONSERVATION TILLAGE SYSTEMS FOR MAJOR CROP PRODUCTION REGIONS IN TEXAS[1]

Production region	Acres Cropland[2]	No Till	Ridge Till	Strip Till	Mulch Till	Reduced Till	Consv. Till[3]
Northern High Plains	5,182,149	50,065	4,000	3,325	959,389	75,139	1,091,918
Southern High Plains	4,283,226	20,225	12,250	4,315	269,788	42,700	349,278
Northern Rolling Plains	1,671,289	1,960	2,750	2,300	402,700	5,450	415,160
Southern Rolling Plains	2,001,734	1,855	0	0	217,135	14,588	233,578
North Central Prairies and West Cross Timbers	869,368	19,480	0	0	187,144	1,925	208,549
Blackland Prairie and Grand Prairie	2,878,000	28,593	800	3	562,226	1,700	593,322
Northeast Texas	393,174	52,355	2,780	0	76,680	15,515	147,330
South Central Texas	1,080,113	26,423	300	10,000	116,009	7,960	160,692
Upper Coast Prairie	1,076,898	6,180	1,056	0	72,409	23,431	103,076
Coastal Bend	666,298	0	0	0	105,550	0	105,550
Lower Valley	962,647	100	41,739	0	30,085	21,100	93,024

[1]Major Production Regions based on Major Land Resource Areas and Texas Crop Reporting Districts.
[2]Total cropland planted.
[3]Total conservation tillage acreage.

dryland wheat (2.13 million acres) comprise the major crops.

Mulch tillage is the predominate type of conservation tillage practice used, accounting for 87 percent of the total in conservation tillage acreage. Reduced-till accounts for 7 percent. No-till production systems represent only 5 percent, but the acreage is expanding.

Fall-seeded small grain, principally wheat, represents about 65 percent of the total conservation tillage in this region. Full-season grain sorghum is about 15 percent and full-season corn about 14 percent of the total conservation tillage being practiced. The USDA-ARS Laboratory at Bushland has shown clear advantages for farmers to adopt a wheat-fallow-sorghum cropping system. Where irrigation water is available, irrigated wheat-fallow should be followed by either dryland or irrigated sorghum. Wheat can be double-cropped after sorghum in irrigated systems. Yields have been superior with the conservation tillage systems, and profits have averaged $30 per acre more for no-tillage over conven-

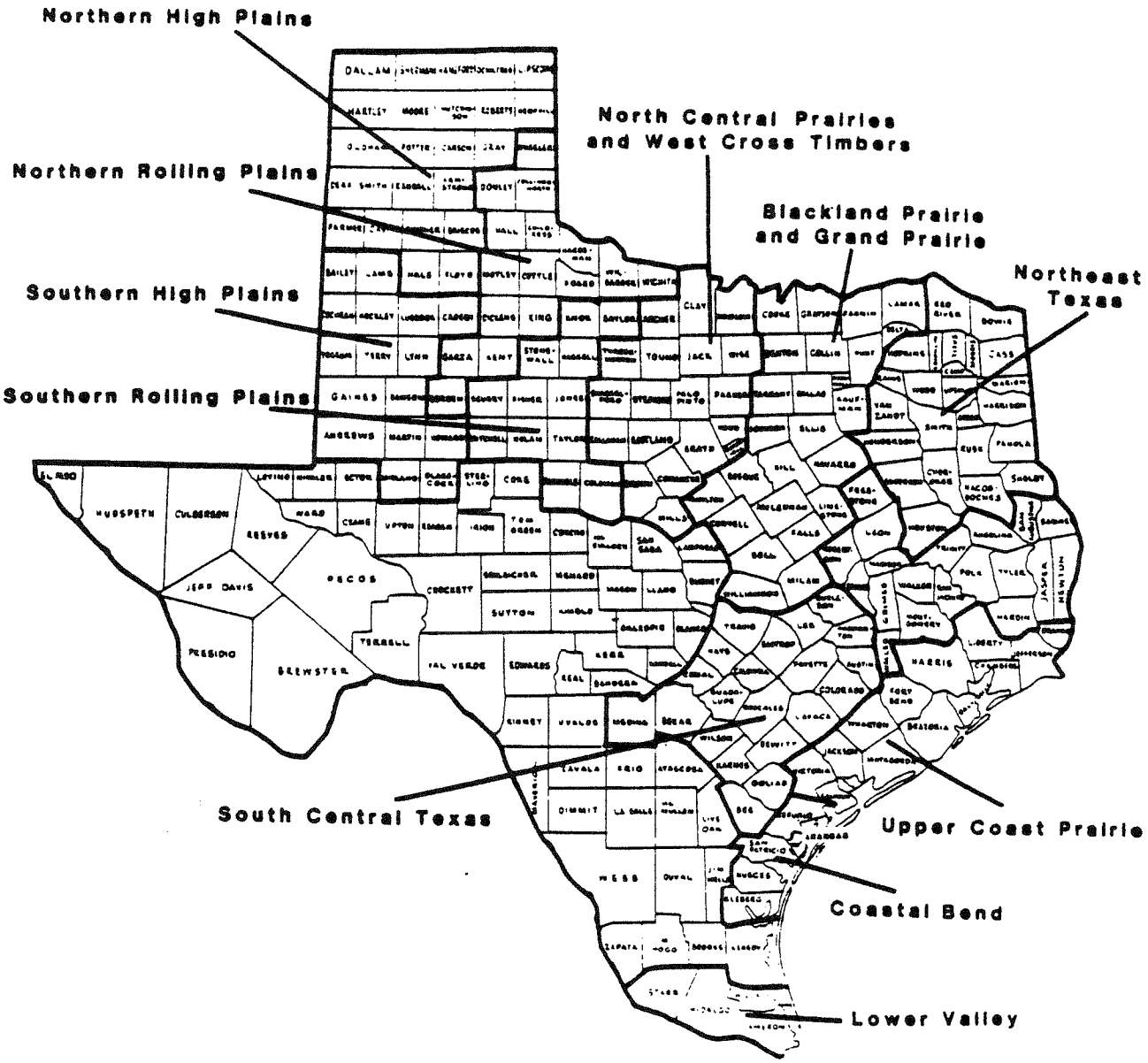


Figure 1. Major Crop Production Regions
(Portions of west and southwest Texas not included)

tional systems involving inversion tillage practices in long-term research at Bushland.

Southern High Plains

The Southern High Plains, an area of sandy soils ranging from fine sands in the southwestern part to fine sandy loams in the northern areas, is comprised of 16 counties totaling 9.9 million acres, of which about 4 million acres are "planted croplands." Of those lands, according to TASS data, corn (70,000 acres), irrigated cotton (921,000 acres), dryland cotton (1.5 million acres), peanuts (47,000 acres), irrigated grain sorghum (141,000 acres), dryland grain sorghum (579,000 acres), soybeans (17,000 acres), irrigated wheat (130,000 acres), and dryland wheat (470,000 acres) comprise the major crops. As with the Northern High Plains, nearly 270,000 acres of the 322,000 acres of conservation tillage systems are in mulch tillage in this region. Reduced tillage, a practice similar to mulch tillage, accounts for about 43,000 acres. Only limited amounts of other conservation production systems are used.

Fall-seeded wheat and other small grains make up about 55 percent of the total acreage of conservation systems. Full-season corn, cotton, and grain sorghum in-

dividually make up about 11 percent of the total conservation tillage systems. Double-cropped grain sorghum is about 10 percent of the total.

Conservation tillage systems are particularly difficult in the Southern High Plains region since the area has a dominance of cotton production and therefore low residue levels. Both dryland wheat and grain sorghum have relatively low production potential in most years, and inadequate irrigation is available for corn production. In about one year out of five, crop failures can be anticipated with wheat and grain sorghum. In many years, rainfall will be inadequate to allow planting of small grain following cotton. Severe wind erosion is common in the Southern High Plains, which makes surface residue cover valuable. A problem arises, however, in attempts to grow plant material that will provide adequate cover to protect the soil surface.

A few innovative farmers have developed no-till cotton production following wheat. However, the acreage of such systems is very limited. Also, farmers have commonly experienced near crop failures with attempts at conservation tillage because of weed control problems with herbicides on coarse, sandy soils.

Northern Rolling Plains

In general, this area has a gently rolling topography with cropland areas ranging from 1 percent to 5 percent slope. Soils vary in texture, ranging from small areas of sands to larger areas of fine sandy loams to clay loams. Both wind erosion and water erosion are problems for this region.

TASS indicates that this 16-county area of 8.7 million acres has about 1.7 million acres of cropland, of which corn (4,000 acres), irrigated cotton (36,000 acres), dryland cotton (496,000 acres), peanuts (6,300), irrigated grain sorghum (4,000 acres), dryland grain sorghum (76,000 acres), irrigated wheat (20,000 acres), and dryland wheat (890,000) comprise the major crops. Wheat, the dominant crop in this region of the state, represents more than 82 percent of the conservation tillage systems being used. Full-season grain sorghum makes up about 5 percent.

Mulch tillage makes up 97 percent by area of the conservation tillage systems practiced in this region (Table 3). Although other types of conservation tillage systems are minor in extent, some innovative systems have been developed for producing crops such as peanuts on sandy soils. Strip tillage, a relatively new practice in the area, has been quite successful in peanut production and is of great value in controlling wind erosion.

Research at Chillicothe-Vernon has shown definite advantages for using furrow diking in wheat, sorghum, and cotton rotations under reduced-tillage systems. Reduced production cost has been a primary driving factor in adoption of conservation tillage practices. Wind erosion control and protection of fragile soils from damaging runoff waters have been additional benefits. Principal problems with conservation tillage systems have been diseases, compaction, and weed control. Soil compaction is a particularly prevalent problem in this region, and considerable research has been directed toward preventing and correcting it. Destruction of plowpans is often necessary for successful conservation tillage systems in this region.

Southern Rolling Plains

This area is dominated by gently rolling landforms and soils with fine sandy loam surface textures. Soils with finer-textured surfaces occur more frequently in the eastern parts of this region. Both wind and water erosion are important problems with which farmers must deal.

TASS indicated that in this 12-county region of 7.26 million acres, about 2 million acres of cropland are planted each year. Corn (2,000 acres), irrigated cotton (27,000 acres), dryland cotton (505,000 acres), peanuts (7,500 acres), irrigated grain sorghum (6,000 acres), dryland grain sorghum (214,000 acres), irrigated wheat (15,000 acres); and dryland wheat (960,000 acres) are the principal crops.

Mulch tillage represents 93 percent of all acreage in conservation tillage in this area (Table 3). Reduced tillage, which is very similar, makes up most of the remainder. Fall-seeded wheat makes up about 86 percent of the acreage in conservation tillage, followed by full-season grain sorghum (6%) and forage crops (7%). Few, if any, conservation tillage systems have been reproted for any other crops. As with the previously discussed areas, conservation tillage practices involve use of chemicals and sweep tillage to maintain a predominance of surface covering residues and avoid the use of inversion types of tillage implements. Rotation systems are common in this region, but few conservation tillage systems are coupled with them. Most of the conservation tillage being practiced is with continuous wheat production.

North Central Prairies and West Cross Timbers

Soils of this region vary from fine sandy loams to clay loam surface textures. Wind erosion is much less of a problem here than in the western areas of the state, but water erosion hazards are more severe.

TASS indicates that this 19-county area makes up a total of 10.47 million acres, of which 1.2 million acres are planted to crops annually, principally corn (2,000 acres), cotton (21,000 acres), peanuts (86,500 acres), grain sorghum (30,000 acres), and wheat (506,000 acres).

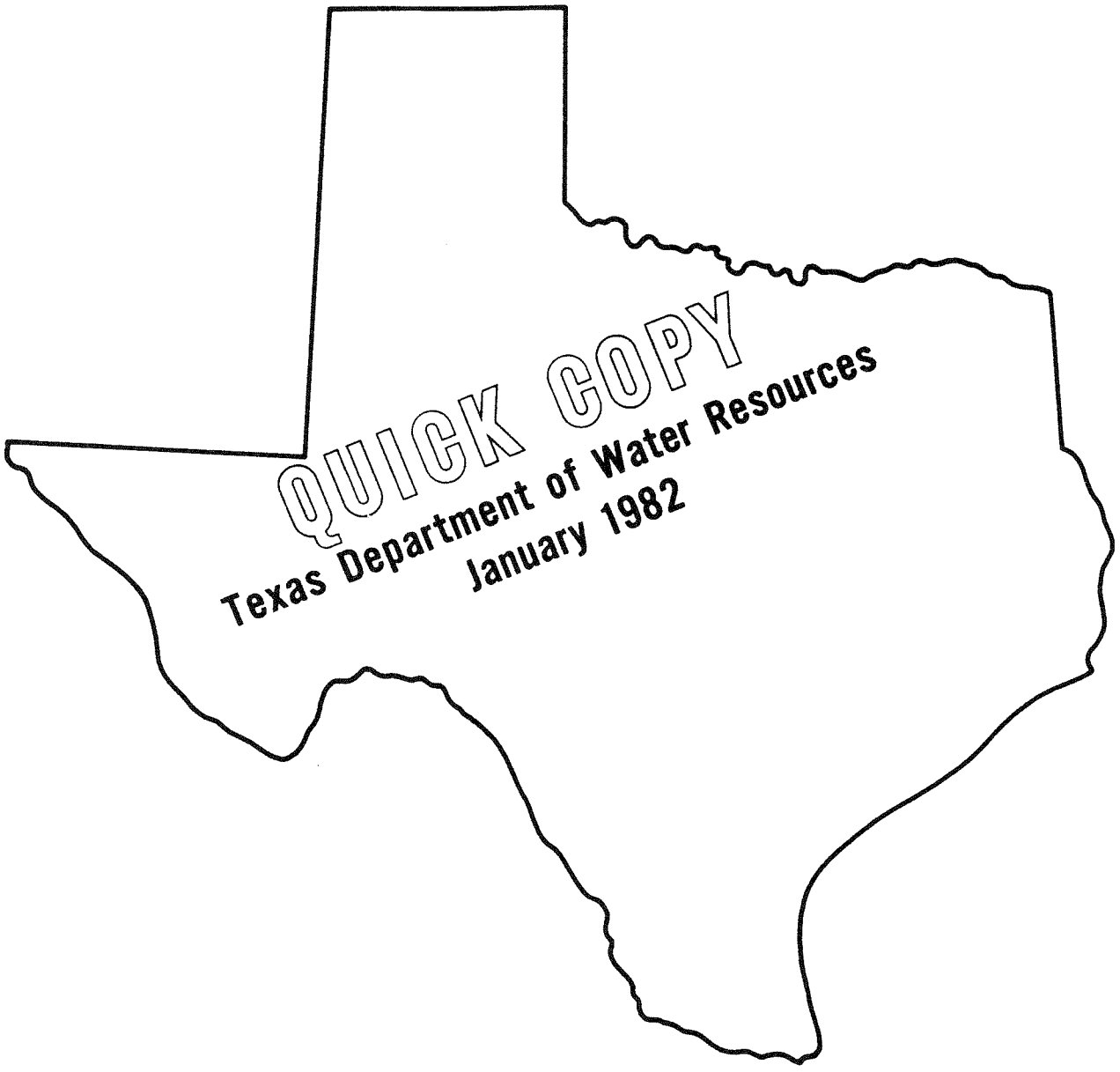
Mulch tillage constitutes about 90 percent of the total conservation tillage practiced in this region (Table 3). No-till production systems make up about 9 percent. Fall-seeded small grain, primarily wheat, makes up about 84 percent of the conservation tillage acreage in this area. The remainder, about 9.3 percent, is primarily in peanut production areas. In this region, about 5 percent of the conservation tillage acreage are attributed to permanent pastures.

Blackland Prairie and Grand Prairie

The Blackland Prairie is an extensive region of deep, clayey soils of relatively uniform texture throughout. The Grand Prairie also is dominated by soils with fine-textured surfaces, but they commonly overlie limestone

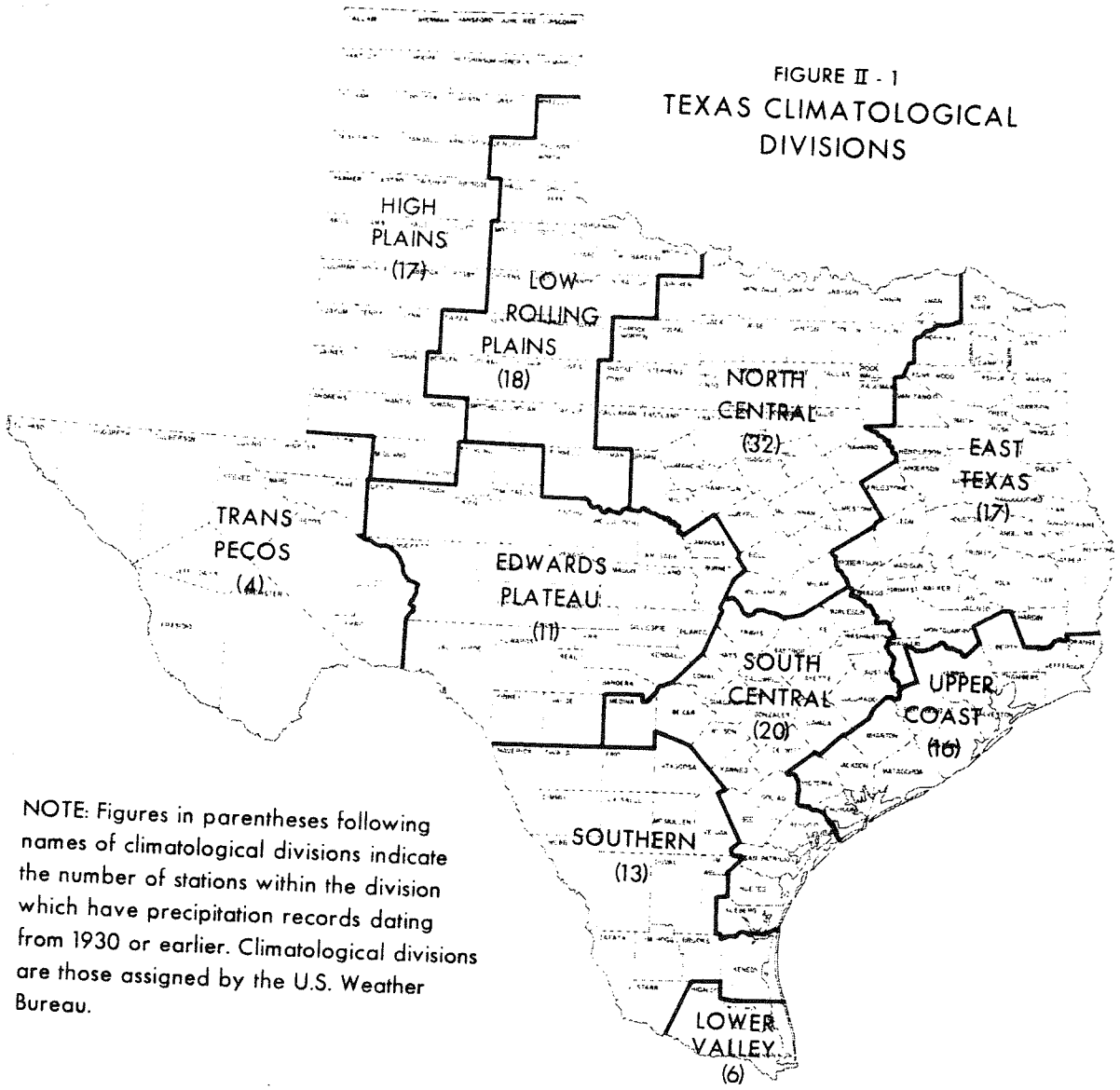
(15)

THE TEXAS WATER PLAN



TEXAS WATER
DEVELOPMENT BOARD
NOVEMBER 1968

FIGURE II - 1
TEXAS CLIMATOLOGICAL DIVISIONS



NOTE: Figures in parentheses following names of climatological divisions indicate the number of stations within the division which have precipitation records dating from 1930 or earlier. Climatological divisions are those assigned by the U.S. Weather Bureau.

ature spread between the coldest and warmest month generally increase with distance from the Gulf of Mexico and with latitude.

In addition to the influence of latitude and proximity to the Gulf of Mexico, physiography exerts an important influence on average annual temperature in Texas, with higher elevations having lower average annual temperatures. This effect is particularly striking in far West Texas.

Evaporation

Lake surface evaporation is influenced by such factors as air and water temperature and wind movement, and generally increases across the State from east to west. While rainfall offsets evaporation to a large extent in East Texas, the western part of the State has high rates of evaporation, with only a low rainfall to help in reducing its effect. This results in lake evaporative losses which are low to moderate in East Texas, but high to very high in West Texas.

As shown in Figure II-8, for the period 1940-1965 the average annual net lake surface evaporation rate was between 0 and 20 inches along the eastern edge of the State, and more than 80 inches in the Big Bend area of West Texas.

Droughts

During the period 1891 to 1960, Texas experienced 11 significant drought periods of varying severity and areal extent, which are shown below:

Most Severe	1954-1956	Seventh	1950-1952
Second	1916-1918	Eighth	1924-1925
Third	1909-1912	Ninth	1891-1893
Fourth	1901	Tenth	1937-1939
Fifth	1953	Eleventh	1896-1899
Sixth	1933-1934		

4. **Under present Texas statutes dealing with water law, potential developers of ground water have no legal protection with respect to continued availability and use of these supplies.**

Without properly planned, positive management programs, aquifers may be over-developed or improperly developed, resulting in possible general economic decline and losses of businesses, premature depletion of supplies locally, and loss of capital investments in wells, pumps, and distribution facilities.

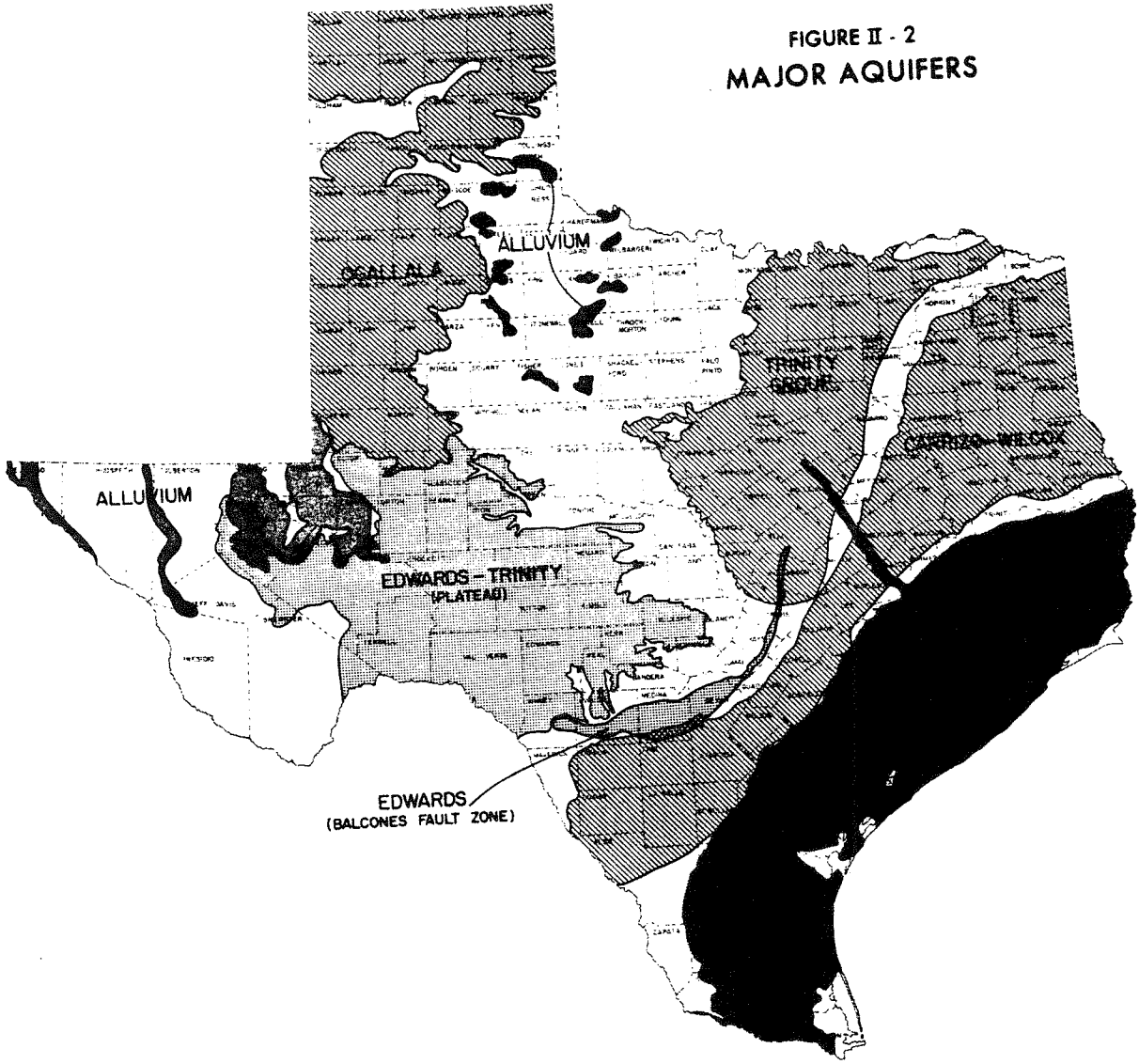
Ground water will nonetheless continue to constitute an important part of the total future water supply of the State. Proper management of aquifers and optimum conjunctive use of ground and surface water resources will be essential in many areas if the total future water requirements of these areas are to be met most economically.

Major Aquifers

During the period 1957 through 1962, the Board, in cooperation with the U.S. Geological Survey, conducted reconnaissance investigations and studies of the ground water resources of the State. Data collected from these studies, as well as previous and subsequent investigations, resulted in the delineation of the major and minor ground water aquifers in Texas, the locations and extent of which are illustrated in Figures II-2 and II-7.

A major aquifer is herein defined as one which yields large quantities of water in a comparatively large area of the State. Major aquifers from which ground water is withdrawn include the Ogallala Aquifer, Alluvium Aquifer, Edwards-Trinity (Plateau) Aquifer, Edwards (Balcones Fault Zone) Aquifer, Trinity Group Aquifer, Carrizo-Wilcox Aquifer, and the Gulf Coast Aquifer,

FIGURE II - 2
MAJOR AQUIFERS



Flip Calhoun, left, and Barry Miller are two Hale County farmers who are looking to enhance income from fewer acres through wine grape production. While there are some pitfalls involved in grape production, the two feel the potential the High Plains has for producing quality grapes will help provide good income from small acreages that are intensively managed.

Grapes may become a vintage crop for the Plains

Hale County producers are aiming at achieving more income from a smaller number of acres

By Jim Steiert, Associate Editor

THE POSSIBILITY of achieving as much gross income from 20 acres of specialty crops as a half-section of grain or cotton has several Hale County farmers trying the production of grapes.

There's a certain glamour associated with viticulture. But two producers who already have experience in it say that successful grape growing involves lots of unglamourous sweat. Pitfalls can come with the new enterprise as well.

Barry Miller, general manager of Texas Prairie Vineyards, has 15 acres of grapes old enough to be in production and 6 more acres that should be in production next year.

Flip Calhoun, a director with the Hale County Soil and Water Conservation District, has 4 acre in production and 3½ acres of new vines. Both vineyards are located near Plainview.

After planting, grape producers can count on a 3-year wait prior to harvesting any fruit and 5 years for meaningful production. But Miller and Calhoun have already encountered a setback in this tough timetable.

"We discovered some varieties we planted may not be suited to our climate. We had a lot of 70 and 80 degree days last winter. A cold snap in February killed some vines, meant the loss of a full year's growth and the labor involved in training the vines," says Calhoun.

"There are close to 300 acres of grapes planted in Hale County. Each

grower essentially has his own experimental vineyard. Some information from the Experiment Station at Lubbock is adaptable to our area, but it isn't specific. We find that the 50 miles distance between Lubbock and Plainview make a big difference. We hope an experimental vineyard at Halfway will help answer some concerns.

"Right now, each producer has to decide for himself which varieties to plant," says Calhoun.

Miller says that after his vines were hurt last winter, he had little choice but to give them another chance by retraining them and letting them go through another winter. Starting with new stock would have meant huge expenses and lost time. "This year's culture is being aimed at stressing vines through the summer to harden them up for winter."

Miller and Calhoun say they may have to look for new rootstock sources in the future in order to find vines better adapted to their area's weather. Hale County growers have also found many grape varieties susceptible to wind damage that can mean loss of half the vine's productivity.

Calhoun says a sturdy trellis system is important. He planted windbreaks of red cedar around his vineyard.

Trained labor is vital in getting grapes into full production. Both men were able to hire experienced grape workers from California. These workers have rotated between the small vineyards of 10 producers in the county.

"Vineyard labor is slow and intense, even when the crew works fast. Each plant has to be touched, sometimes once a week. You're talking about thousands of vines that are hand-tended intensively during the summer," says Miller. "We've had to adjust our thinking to small acres. Twenty-one acres doesn't sound like much until you look at all the thousands of dollars an acre you invest, the labor and the time required to get into production.

"A producer shouldn't overdo it in the beginning. Five acres is enough to keep a full-time man busy. It's hard to downscale your thinking, but you can get more acres than you can handle in a hurry," says Miller.

A producer will invest several thousand dollars an acre before realizing a return on his investment. Calhoun and Miller estimate that $1.5 million has been invested by grape producers in the county and that does not include the cost of land.

Flip Calhoun, Barry Miller and Hale County SWCD District Conservationist Jimmy Lewis examine grape plants in Calhoun's vineyards, just outside Plainview. Lewis helped Calhoun plan the layout of his vineyard and also designed the drip irrigation system for it. Calhoun and Miller are among a handful of Hale County producers who have planted nearly 300 acres of wine grapes as an alternate crop.

Miller says High Plains growers have found that an apple stem borer attacks grape vines. A handful of diseases also occur. "Hail is one of the biggest hazards to us here. It can devastate a vineyard, and its effects are evident for several years. We haven't encountered anything in the way of diseases or insects we haven't been able to control."

Both men know the liabilities of the crop, but they also see great possibilities for it. "We have quantity and quality possibilities with grape production in this area and we're satisfied with the market. This is a means to diversify our agriculture and the High Plains can produce a quality grape that should be sought after by wineries," says Miller.

Calhoun says grapes give a maximum return on irrigation. "Although they're expensive and labor intense, there's a lot of return for the small amount of irrigation you put in. We've given our water away on a lot of cheap crops. We can realize anywhere from $600 to $1,200 a ton for grapes, and they can make five tons per acre in full production."

District conservationist Jimmy Lewis, is given a lot of credit by Calhoun and Miller for helping grape production get sarted in the Plainview area. Lewis designed a drip irrigation system for Calhoun's vineyard and also did extensive preparatory work prior to vineyard plantings.

Calhoun says growers in the county are now working to produce quality grapes. They hope to earn a reputation for their county and the High Plains as source of top quality wine grapes.

"A winery can't make vintage stuff out of junk. Our local growers are committed to quality over quantity. We're really not even competing with each other. All of us share equipment and ideas as we try to learn this business," says Calhoun.

Miller contracted his grapes with Llano Estacado Winery at Lubbock and Calhoun contracted with Messina Hoff Winery in Bryan. They say there are a number of good varieties of grapes available for the High Plains.

"We'll have advantage in climate over other production areas of Texas that should help us produce quality grapes. We look at viticulture as a way to diversify. As supply approaches demand there'll be an adjustment of prices offered growers, but there will always be a price for good quality wine grapes.

"We didn't know much about grapes when we started. We're still learning. Now, at least, we can pronounce the names of the different varieties," says Miller.#

BUSINESS WIRE

- *Intoxicating Profits*
- *Israel Plants Texas Roots*
- *Houston's Supercomputer*
- *Crime-busting at the Stop-and-Rob*
- *Byte-size Banking*

17

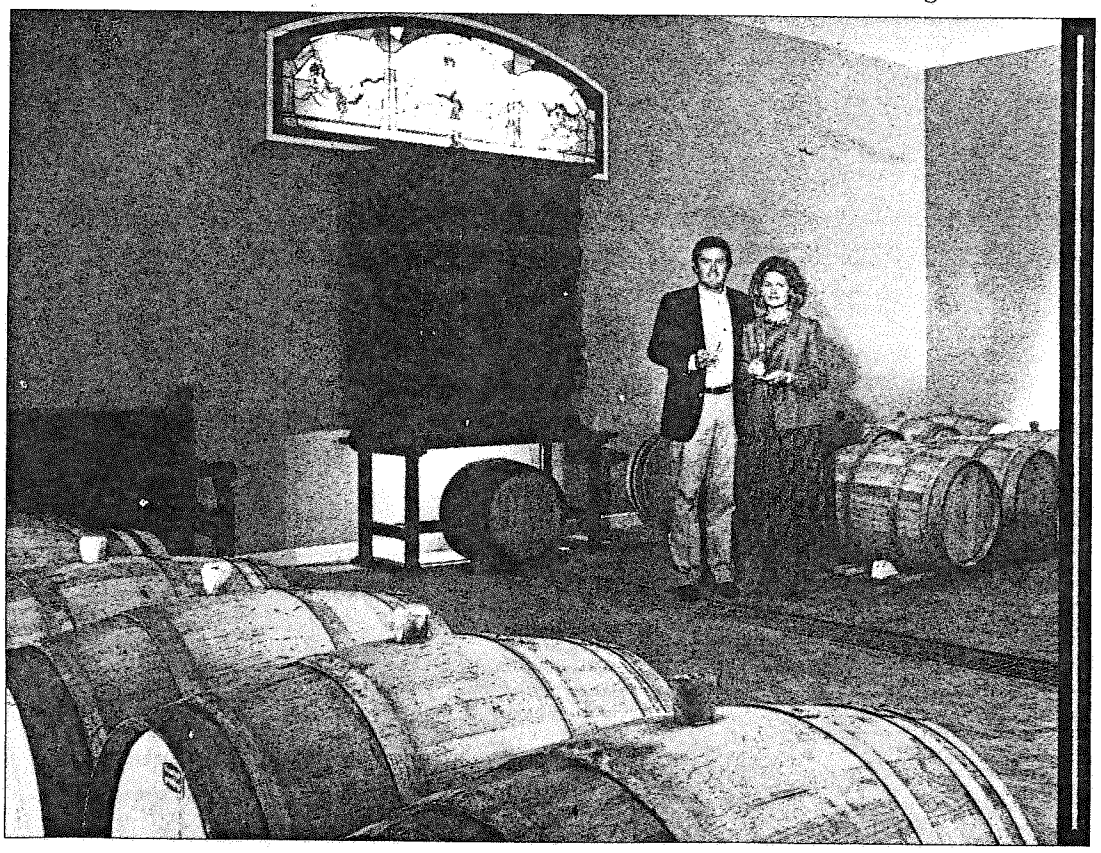
By Gary Taylor

The Wine Industry—Coming Of Age in Texas?

"But for a quirk of history," insists Austin businessman Ed Auler, "Texas would already be the nation's number one wine state."

It's a heady challenge to make in a region that includes California, but Texas wine entrepreneurs are feeling cocky these days. As Colorado works hard to develop its fledgling wine industry from grape vineyards on the state's western slope, California may soon be bracing for competition. With the Texas industry entering its second decade, Lone Star winemaking should begin to ripen. And Auler is quick to detail the history.

Auler argues that a quirk in the seventeenth century proves it's never too late where wine is concerned. It seems, he explains, the first primitive attempts at establishing vineyards in Texas occurred in the wrong part of the state, near Galveston, where Franciscan monks tried transplanting European vine stocks. Insects and the harsh South Texas climate defeated their efforts, and, in the intervening centuries, California cultivated its reputation for wine while Texas came to stand for beer and bourbon. Thus, it was with great casks of courage that Auler, the University of Texas and a handful of wine faithfuls decided during the last decade to correct that his-



The owner of Fall Creek Winery and president of the Texas Grape Growers Council, Ed Auler faces formidable opposition in his campaign to make Texas wines a success. To many consumers, the phrase "wine from Texas" still sounds like a contradiction in terms. Auler believes Texas' best weapon will be a European-quality product.

torical quirk and accept the high-risk, capital-intensive challenge of starting up a wine industry in the Lone Star State.

As the first—and the current—president of the Texas Grape Growers Council, Auler, owner of Fall Creek Winery, hardly qualifies as an impartial source on the prospects of the state's young wine industry. But he can testify about the tough nature of the challenge. And he offers some impressive figures to support his contention that Texas will soon lag behind only California in this potentially lucrative industry.

For starters, he boasts that Texas wines have already won awards despite the fact that they hail from mere infant vineyards. Quality European vineyards may be centuries old, and their best wines certainly wouldn't come from any vine stocks younger than 50 years. Yet Texas wines from four-year-old vines are already winning praise for their quality. And quality—European quality—will play an important role in overcoming the hurdles facing the industry's growth.

Beyond the natural enemies and the lack of an existing wine technology, Auler and his vineyard henchmen are slugging it out with an even stronger opponent. They can handle the hail and the insects and they can plow new technological ground, learning the industry from scratch. But the phrase "wine from Texas" still elicits grins in many quarters as a contradiction in terms. Their best weapon will be a quality, European product. And the state's wine pioneers insist that Texas can produce one.

The past decade has seen 18 or 19 wineries sprout in Texas after scientists pinpointed three regions where the soil would be compatible with European vines: Hill Country, High Plains and Trans Pecos. None are yet realizing profits from these high-risk investments, but Auler firmly believes the return is just several years away. Even UT has realized the opportunities, converting a small part of its West Texas oil lands into vineyards. A UT marketing study noted that mature, fully producing vineyards can earn $1,000 to $2,500 per acre.

"It's a real big carrot," asserts Auler. "The gross potential of a vineyard exceeds any other agricultural venture."

There's no real father of the Texas wine industry. Auler's just one of seven or eight entrepreneurs willing to take the risk in the early seventies and study the industry's potential. Some early pioneers have already sold their primitive wineries, and, like any other fledgling endeavor, the wine business has chalked up some casualties. Nevertheless, the potential for Texas commerce is something to ponder. And there can be no doubt that creating a wine industry from nothing—in Texas—must rank in anyone's catalog of tough start-up ventures.

"It's a labor-intensive business once it's thriving and could be a big employer in the state," says Auler. "It was a tough start-up because there really was nothing to copy. No one had tried to make high-quality wines here. Today, it looks like they'll be second to none." ▶

(18)

Our TEXAS

REVISED EDITION

RALPH W. STEEN

HEAD OF DEPARTMENT OF HISTORY, THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

FRANCES DONECKER

TEACHER OF HISTORY, JUNIOR SCHOOLS, SAN ANTONIO, TEXAS

ILLUSTRATED BY

WARREN HUNTER

PUBLISHED BY

THE STECK COMPANY • AUSTIN

PRINTED AND BOUND IN THE UNITED STATES OF AMERICA

more than 750,000 in 1900. By 1900 there was no longer a frontier in Texas.

West Texas Agriculture. For many years, people considered the High Plains a "great American desert" and thought the area entirely unsuited to agriculture. Much of West Texas is in the High Plains region. The cattleman occupied this section of the state in the years following the War between the States and found it to be well suited to the growing of cattle. However, he was not permitted to occupy this new land in peace and had to retreat steadily before the advancing farmers. The ranches of the South Plains section of the High Plains have long since given place to fields of cotton, and the Panhandle section has been found well suited to the large-scale production of wheat.

In the High Plains is found approximately one half of the irrigated land in Texas. Grain sorghum is the leading irrigated crop, with cotton ranking second.

It is not possible to discuss all of the developments in agriculture, but the cotton industry on the South Plains can be taken as an example of the general development. In 1917 only 81,000 bales of cotton were produced in the counties lying west of the 100th meridian. Ten years later the same area produced 1,130,000 bales. It was found that the land was fertile and that the high altitude helped prevent the appearance of the boll weevil. The rainfall is limited, but it has excellent seasonal distribution.

The plains farmer does not follow the same pattern that is followed in areas where the rainfall is greater. The plains farms are larger, and the farmer seeks a large yield per man employed rather than a large yield per acre. Even though the farmer has taken over many acres on the plains, the area has a number of large ranches.

Machines and Agriculture. After the War between the States, it was necessary to develop a new system of agriculture based on free labor. The chief feature of the new system was the one-family farm. Some of these one-family farms were worked by owners and some by tenants.

Courtesy Texas Highway Department

WHEAT HARVEST ON THE HIGH PLAINS

Although the one-family farm continues to be a feature of Texas agriculture, machines have done a great deal to modify the system. To a considerable degree, tractors have replaced horses and mules as a means of farm power. Tractors, together with two-row and three-row equipment, combines, and other machines, make it possible for one man to farm a much larger area than he could farm fifty years ago. As a result, the number of farms has decreased, and the size of the average farm has increased.

Machines have also had a part in developing a group of workers known as agricultural laborers. Large blocks of land are combined into one great farm, and agricultural laborers are employed by the day, as needed, to operate the machinery. Many persons who were tenants a few years ago are now agricultural laborers.

The federal farm program, which grew out of the depression, also had a part in reducing the number of tenants. Much poor land was retired from cultivation. At the same

19

texas
land of contrast

It's true.

Talk about contrast, this is it!

From Judge Roy Bean to moon men.

From lush woodlands to stark desert.

From sparkling surf to mile-high mountains.

And lots more in between.

One nice thing about a land of contrast

(besides all the pleasant surprises)

there's enough variety so you can pick

just what appeals to you.

Sort of tailor-make your own vacation.

Texas has got it all together!

Texas Highway Dept.

About this book

Because of Texas' diversity and almost overwhelming size, this book presents the state in 10 regions as illustrated below. Those regional names are the first 10 listings in the Table of Contents to the right. To facilitate finding descriptions of the regions, flex the edge of the book so that corresponding color bars become visible.

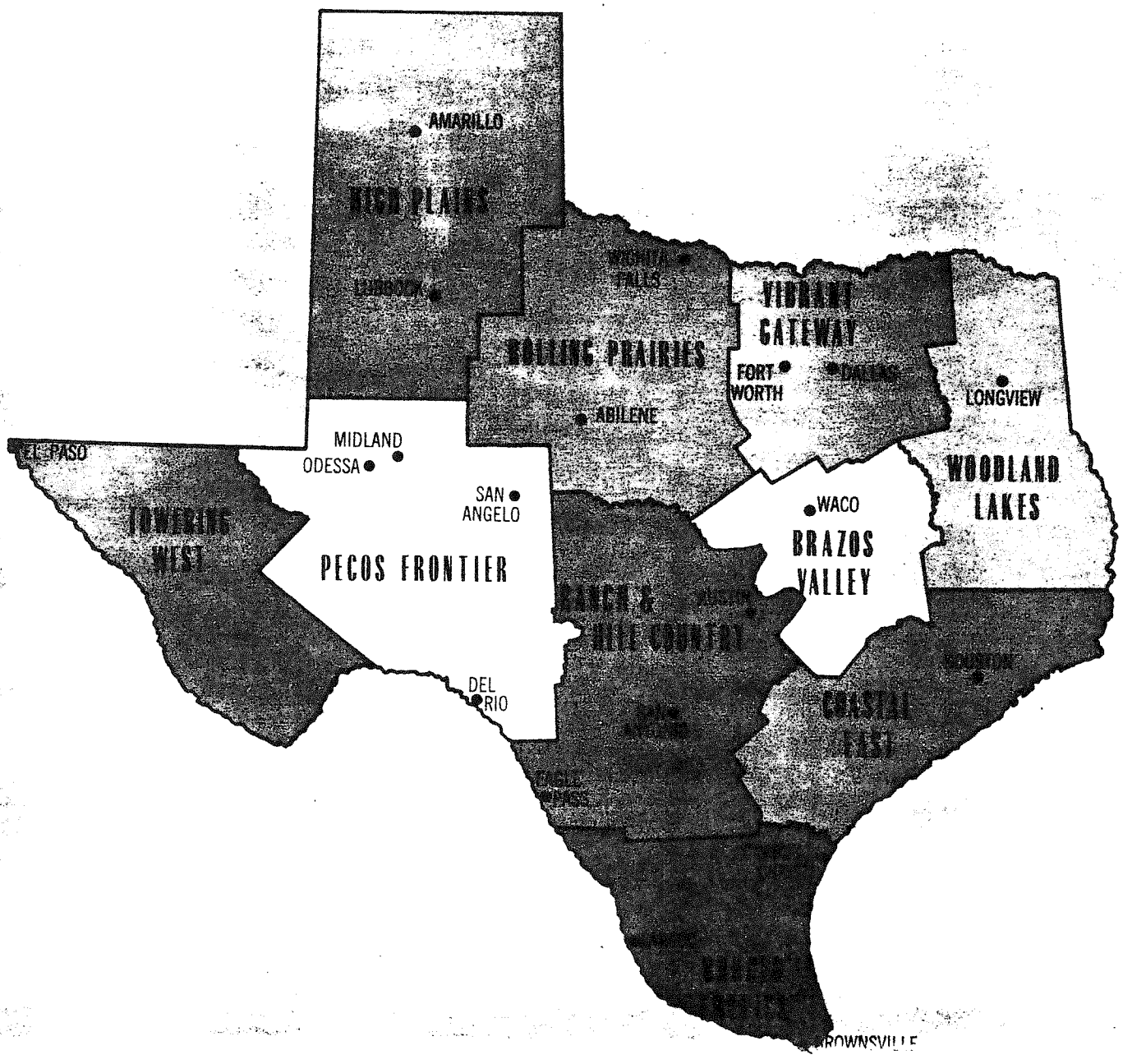
Each region is introduced by a detailed section map. Attractions and points of interest are listed under the city where they are located; cities are arranged in alphabetical order. Public campgrounds are listed at the end of each regional section.

The map on page 204 joins all the regions, and shows major highways, cities and towns. For a complete state driving map, refer to the Official Highway Travel Map available free from the Texas Highway Department.

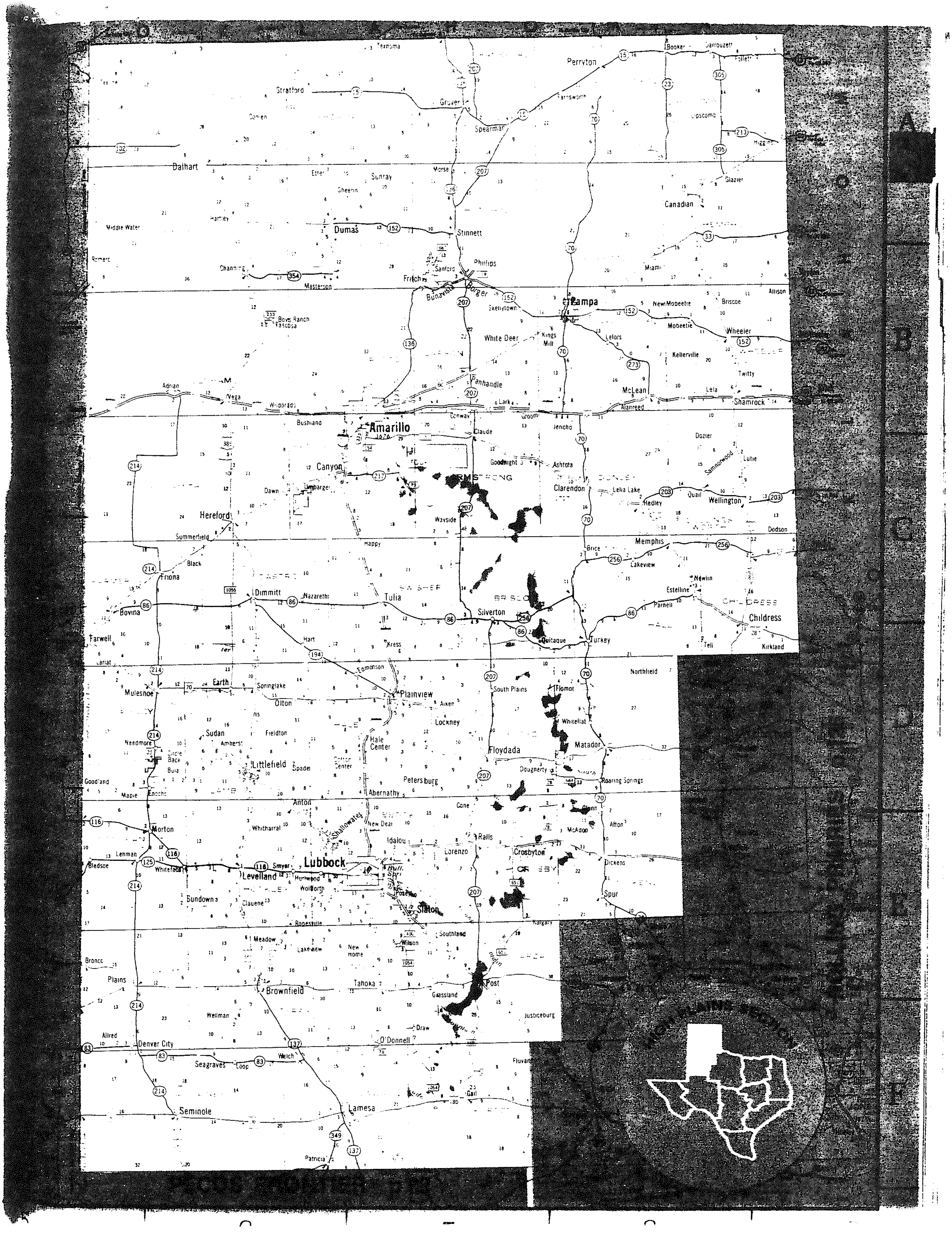
Note that the Table of Contents also lists several special interest sections toward the end of the book. Those sections give capsule information on such subjects as state parks, national forests and major events.

Highway designations in the book include **I.H.** for Interstate highways, **U.S.** for U.S. highways, **Texas** for state highways, and **F.M.** or **R.M.** for Texas Farm or Ranch Roads. All F.M. and R.M. roads are part of the state highway system, and are fine paved routes.

This book does not list auto services, accommodations or restaurants because many commercial guides are available on those subjects.




HIGH PLAINS
ROLLING PRAIRIES
VIBRANT GATEWAY
WOODLAND LAKES
TOWERING WEST
PECOS FRONTIER
BRAZOS VALLEY
RANCH & HILL COUNTRY
COASTAL EAST
BORDER TROPICS
NEW MEXICO
REPUBLIC OF MEXICO
texas
landforms
drive friendly!
Interstate Highway
U. S. Highway
State Highway
Farm or Ranch Road
Tourist Bureau


A
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Texhoma
Booker
Darrouzett
Follett
Perryton
Stratford
Gruver
Spearman
Farnsworth
Lipscomb
Higgins
Dalhart
Sunray
Morse
Glazier
Canadian
Hartley
Dumas
Stinnett
Middle Water
Channing
Masterson
Sanford
Phillips
Fritch
Borger
Miami
Allison
Pampa
Skellytown
Briscoe
Wheeler
Mobeetie
Boys Ranch
Tascosa
White Deer
Lefors
Kellerville
Panhandle
McLean
Twitty
Adrian
Vega
Wildorado
Lark
Groom
Alanreed
Shamrock
Bushland
Amarillo
Claude
Jericho
Dozier
Canyon
Goodnight
Ashtola
Dawn
Umbarger
Clarendon
Lelia Lake
Hedley
Quail
Wellington
Hereford
Wayside
Summerfield
Dodson
Happy
Brice
Memphis
Lakeview
Friona
Black
Newlin
Estelline
Dimmitt
Nazareth
Tulia
Bovina
Silverton
Childress
Parnell
Farwell
Hart
Kress
Quitaque
Turkey
Kirkland
Earth
Springlake
Muleshoe
Plainview
Olton
Aiken
South Plains
Flomot
Northfield
Lockney
Sudan
Fieldton
Amherst
Whiteflat
Hale Center
Matador
Littlefield
Floydada
Spade
Cotton Center
Petersburg
Roaring Springs
Abernathy
Anton
Morton
Whitharral
Shallowater
New Deal
Idalou
Ralls
McAdoo
Afton
Lubbock
Levelland
Smyer
Lorenzo
Crosbyton
Dickens
Whiteface
Bledsoe
Wolfforth
Sundown
Slaton
Spur
Ropesville
Southland
Meadow
Lakeview
Wilson
New Home
Plains
Brownfield
Tahoka
Post
Grassland
Justiceburg
Wellman
Allred
Denver City
O'Donnell
Welch
Seagraves
Loop
Fluvanna
Gail
Seminole
Lamesa
Patricia
HIGH PLAINS REGION

TEXAS HIGHWAY DEPARTMENT TOURIST BUREAU, AMARILLO

WHERE TO GO, WHAT TO SEE

General — Commercial, cultural and recreational center for vast plains of the Texas Panhandle. World's leading helium producer. Superb climate with air rated cleanest in the nation for city of its size. Fifty-two city parks cover 2,300 acres including tennis courts, swimming pools, fishing lakes, playgrounds, amusement park, Storyland Zoo, and golf course.

First settlement was in 1887 a buffalo hide tent camp of railroad construction workers. Today excellent motel and hotel facilities, spacious convention and civic center, symphony orchestra, ballet, and little theater. Contact chamber of commerce for details. 301 S. Polk St.

Major Events — Amarillo Fat Stock Show and RCA Rodeo, six days in Jan.

National Women's Invitational (collegiate basketball) Tournament, third week in Mar.

Greater Southwest Music Festival for junior and high school bands and choirs, attracts over 12,000 participants from five states; last weekend in Apr.

Will Rogers Range Riders Rodeo, traditional cowboy events in early July.

Palo Duro Canyon Trail Ride, two days in Aug. Dramatic scenery of Palo Duro Canyon draws hosts of riders.

Boys Ranch Rodeo, near Labor Day at Cal Farley's Boys Ranch, northwest of Amarillo. (See TASCOSA this section.)

Tri-State Fair, six days in Sept. Thousands of visitors from the vast Panhandle-Plains area and neighboring states.

National Hot Rod Association World Finals attracts 30,000 racing fans for three days the first weekend in Oct.

National Anxiety Hereford Breeders' Show, two days in Nov.

Amarillo Art Center — Magnificent complex of three buildings designed by Edward Stone (Kennedy Center, Wash., D.C.), devoted to fine arts, music, and drama, combining both exhibition space and teaching areas. Excellent permanent collection of painting and sculpture, plus regular performing arts. 2200 Van Buren St., on the campus of Amarillo College.

Amarillo College — Municipally operated junior college established 1929 enrolling more than 10,000 students. Washington St.

American Quarter Horse Association — Headquarters for world's largest equine registry, over 615,000 horses registered in 40 countries. Quarter horse was the first American horse breed, and is still the favorite mount of cowboys.

Bivins Memorial Library — In a Texas Medallion building, former home of Lee Bivins, onetime Amarillo mayor and world's biggest cattle owner. Bush Room of the library contains rare books recounting history of the Panhandle and frontier. Family histories may be traced in special collection in Genealogy Room. Tenth and Polk Sts.

Buffalo Lake National Wildlife Refuge — See LAKES this section.

Cal Farley's Boys Ranch — See TASCOSA this section.

Garden Center — Lavish floral displays edge immaculate lawns, walkways, and picnic areas in 51-acre park adjacent to the Amarillo Medical Center on west side of city. 1400 Streit St.

Helium Monument — Six-story stainless steel Time Column erected 1968 commemorates the unusual natural element found here in world's greatest quantity. Adjacent pavilion houses historical and scientific data, exhibits and tourist information center. Daily, 10 a.m. - 6 p.m. I.H. 40 at Nelson St.

high plains

For a complete state driving map, refer to the Official Highway Travel Map available free from the Texas Highway Department.

legend

- (35) Interstate Highway
- (90) U. S. Highway
- (240) Park Road
- (72) State Highway
- (214) Farm or Ranch Road
- (306) Loop or Spur
- •Rest Area
- ▪Comfort Station
- ★Tourist Bureau
- 870 Altitude

The Plains Trail spans the vast tableland called Llano Estacado by the Spanish; today known as the "Golden Spread" for the rich yields from its earth. Route marked in light yellow on High Plains map. (also see Travel Trails section, page 180)

GREATER

LUBBOCK

NOVEMBER 1985

LUBBOCK, TEXAS
on the PLAINS

A Publication of the
LUBBOCK CHAMBER OF COMMERCE
and BOARD OF CITY DEVELOPMENT

Lubbock Wineries Win Top State Prizes

The Westin Galleria Hotel in Dallas hosted the October 16th Awards Dinner for the 1985 Lone Star State Wine Competition. Thirteen Texas commercial wineries submitted over 70 wines for evaluation by a panel of prominent wine authorities. Lubbock's two wineries, Llano Estacado Winery and Pheasant Ridge Winery, garnered half of the 22 medals awarded.

Bobby and Jennifer Cox of Pheasant Ridge Winery won the coveted Star of Texas Grand Award and the event's only gold medal with their excellent 1984 Lubbock County Chardonnay. Pheasant Ridge 1984 Sauvignon Blanc and 1983 Cabernet Sauvignon both merited silver medals while their 1984 Dry Chenin Blanc was awarded a bronze medal.

Llano Estacado's wines were awarded seven medals. The four silver medal winners were: 1984 Leftwich-Slaughter Vineyard Chardonnay; 1984 Crosnoe Vineyard Chenin Blanc; 1984 Hagens Vineyard Johannisberg Riesling; and 1984 Leftwich-Slaughter Vineyard Rose of Cabernet. Taking bronze medals were: 1984 Leftwich-Slaughter Vineyard White Cabernet; 1984 Cox Vineyard French Colombard; and 1983 Leftwich-Slaughter Vineyard Cabernet Sauvignon.

The competition is sponsored annually by the Texas Grape Growers Association, the Texas Department of Agriculture and Southwest Airlines. This year's panel of ten judges included Gerald Asher, wine editor, *Gourmet*, San Francisco; Ron Fonte, publisher and president, *Les Amis du Vin*, Silver Springs, Maryland; Ralph Hutchinson, wine writer, La Verne, California; Dee Ann Stone, editor, *Arbor Magazine*, Atlanta. In-state judges were Bob Lowe, wine writer, *Austin American Statesman*, Austin; Diane Teitelbaum, wine columnist, *Dallas Times Herald*, Dallas; Paul Pinnell, food and beverage director, Plaza of the Americas, Dallas; Arjon Tabatabai, owner, Beajen's Restaurants, San Antonio; Henry Elkouri, vice president, Majestic Liquor Stores, Fort Worth; Scott Spencer, owner, Wines of America, Houston.

Lubbock's two wineries accounted for the only gold medal awarded, 60% of the ten silver medals, and nearly 40% of the eleven bronze medals. Such domination is not a new phenomenon. In the two major 1984 Texas wine competitions a total of four gold medals were awarded. Llano Estacado won three of those medals and Pheasant Ridge took the fourth.

Many factors enter into the quality of Lubbock's wines. The most important ingredient is certainly the quality of the winegrapes produced in this area. It is said that 75% of the quality in a bottle of wine is determined in the vineyard before the grapes are harvested. Extraordinary grape quality requires both an appropriate environment and a generous amount of skillful diligence on the part of the grower.

Lubbock is blessed with the soil, water and climate for premium winegrape production. The area is also fortunate in that many of it's grape growers are dedicated to excellence. Pioneer growers such as Bobby Cox, Allen Hagens and Scott Slaughter have produced the grapes for many award winning wines. Exciting new vineyards are maturing and numerous growers are striving to make their mark. That spells a bright future for the young Lubbock wine industry.

Other essential elements in the production of premium wines are state-of-the-art equipment and talented, dedicated winemaking personnel. A tour through the Llano Estacado Winery will demonstrate the enormity of the investment in equipment for a relatively small winery.

Lubbock's dominance in the Long Star State Wine Competition was extended into the non-commercial entries as well by Don Brady. Don's wines received the only Blue Ribbon awarded, three of the four Red Ribbons and two White Ribbons. Twelve other non-commercial winemakers submitted entries. Don Brady recently surrendered his non-commercial status when he joined the winemaking staff at Llano Estacado. His obvious talent and tireless dedication to the making of premium wines enhance the future of the Lubbock wine industry.

Many people are committed to making Lubbock the focal point of quality wine production in Texas, a state which may well become the second largest wine producer in the nation.

What's Happening in Lubbock

November

2	FESTIVAL — Oktoberfest: Arts & Crafts Sale & German Sausage BBQ. St. Christopher's, 42nd & Elgin. 799-8280
5	LECTURE — West Texas Watercolor Society. Frank Cheatum, Garden and Arts Center. 7:30 p.m., 799-4287
8-9	THEATRE — "Tintypes." Moody Auditorium, Lubbock Christian College. 8:00 p.m., 792-3221
9	OTHER — Nutcracker Ball/Gala, sponsored by Ballet Lubbock, Lubbock Country Club. 7:30-12:30 p.m., 794-3752
10	MUSIC — Guest Artist, Bob Daniel, tuba. Hemmle Recital Hall, Texas Tech University. 8:00 p.m., 742-2294
10	EXHIBIT — Maurio Lasansky. The Museum, Texas Tech University, Museum Hours. 742-2443
13-16	OTHER — Holiday Happening, sponsored by The Junior League of Lubbock, Lubbock Memorial Civic Center, Thurs. 1:00-9:00 p.m., Fri. 11:00-9:00 p.m., Sat. 10:00-8:00 p.m., 795-5215
14-18	THEATRE — "Monday After the Miracle." Texas Tech University Theatre, 8:15 p.m., 11th & 13th, 2:00 p.m. & 8:15 p.m., 742-3601
14	EXHIBIT — Racing Photos, sponsored by The Lubbock Camera Club. Garden and Arts Center. 7:30 p.m., 792-0150
15	MUSIC — Terry Cook, bass-baritone, sponsored by Lubbock Symphony Orchestra, Lubbock Memorial Civic Center. 8:15 p.m., 762-4707
16	DANCE — Story Dance Theatre, sponsored by Ballet Lubbock. Lubbock Memorial Civic Center Banquet Room. 10:30-12:00 p.m., 794-3752
19	LECTURE — Writing Children's Stories, Georgann Kastner, sponsored by South Plains Writers Association. Garden and Arts Center. 7:30 p.m., 797-8153
21	OTHER — St. Andrew's Pot-Luck Dinner and Program, The Perfection of Bagpipes In The World, sponsored by The West Texas Scottish Heritage Society. 6:45 p.m., 792-6512
21	LECTURE — Film Directing, Robert Wise, sponsored by U.C. Activities. 8:15 p.m., 742-3621
22	OTHER — Lubbock Heritage Society Annual Gala, for more information call 742-2443
23	MUSIC — University Symphony Band, Hemmle Recital Hall, Texas Tech University, 8:15 p.m., 742-2294
24	MUSIC — Senior Citizens Concert, sponsored by Lubbock Symphony Orchestra and Hudson-Dayton Foundation. Lubbock Memorial Civic Center Theatre, 3:00 p.m., 762-4707

WORDS ON WINE & SPIRITS

High plains vintner industry leader

JOHN CASEY

As recently as six or seven years ago, it was the "in" thing to become "involved" in a vineyard. I watched the progress of some of these "flings" into wine. Some are still around and still struggling; many have become the topic of party conversation. Still others have become the backbone of the growing Texas wine industry.

If I had to pick one person who has spearheaded this "crusade" to legitimize Texas' newest large potential business, it would be Dick Bill of San Antonio. Back in the early 1980's he became associated with a group of amateur grape growers in Lubbock who had already proven the point that good wine grapes could be grown in Texas and especially around Lubbock. Now chairman of the board of the Llano Estacado Winery, Dick can be proud of his shepherding of these meager beginnings into the second largest Texas producer of good quality wines.

"Good" is not strong enough to describe the quality of some of the wines of Llano Estacado, yet if I said "fine" it would not apply to all of their products. Llano Estacado is trying to do it right. They have some of the best vinting equipment available and at a very high price. The quality of some of their wines is testimony to their ability to use it properly. If there is reason to criticize this winery it is for the usual mistake made by a fledgling in business: Too many products. This operation produces less than 100,000 gallons of wine, but has 11 labels. I have been told that there is a move afoot to back off and do fewer and make more of the wines they do best.

I sampled some of the more recent production from Llano Estacado. The 1984 Chardonnay is young and should mellow out in the bottle. It is fresh and has a good acid balance. It is not at all foxy, yet has a unique fruit that doesn't get out of hand. Nice and dry, it will go well with unsauced seafood and shellfish.

The Chenin Blanc is nice and clean without too much residual sugar. With a sufficient amount of acid, its finish is pleasant. A nice wine to go with finger sandwiches, cheese spreads, aspics and other light party fare. It will also please the fans of "not so dry" wines for sipping.

The Dry Chenin Blanc is very nice. It is a happy combination of light fruitness and the absence of sugar. It will go almost anywhere you would take Chardonnay and in some cases be a better match to some food. Mix it half and half with club soda, load it with ice in a tall glass and you will have a good, low alcohol summer drink.

Llano Estacado is making a Rose from the Ruby Cabernet grape. It has a rather large body for a rose and with the berry-like fruit it is interesting. It is not dry and will go with some of the sweetish sauces.

The Sauvignon Blanc is not totally dry. It is not to be deemed sweet either. It is a little bigger wine than the Dry Chenin, with less fruit and a more neutral character. It will go with foods like chicken and veal in cream sauces and even with some glazed meats.

The Ruby Cabernet is also used for another wine at Llano Estacado. It is a light bodied wine that you can drink as well as sip. It is dry and has a rather high alcoholic content. This wine too, has an almost berry-like fruit. At Llano Estacado, this wine is called Premium Red. This is perhaps a bit better chilled.

A Cabernet is also being produced at Llano Estacado, but at this writing I have not sampled their latest release.

Llano Estacado has come along in a short time. They deserve the success that comes from hard work and patience. If they would cut back to about four or five wines, I believe total success would find them faster. If they keep their prices realistic, they should sell their production with no trouble.

October 1968

24

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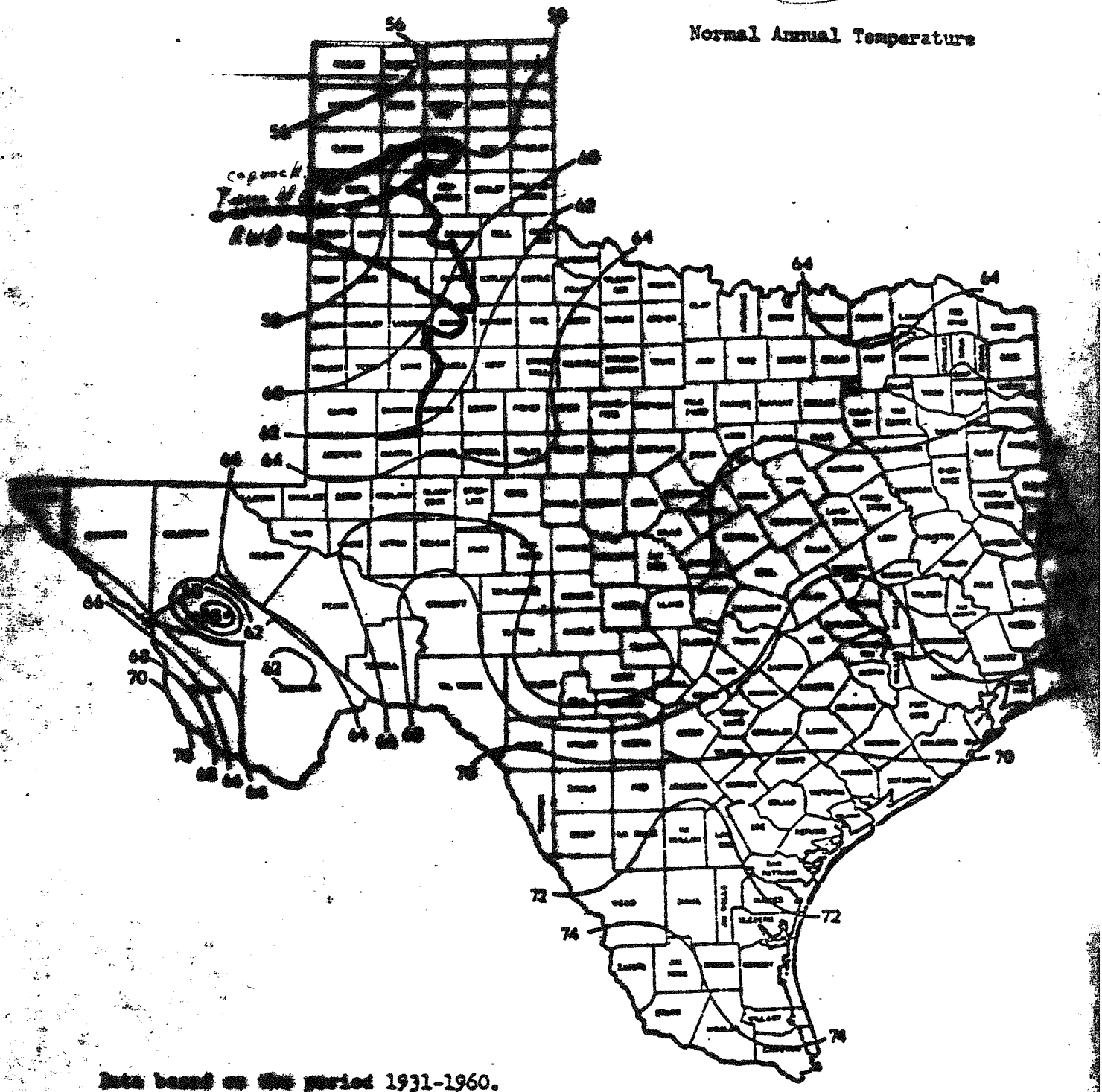
Normal Annual Temperature



Data based on the period 1931-1960.

WEATHER BUREAU STATE CLIMATOLOGIST
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
[illegible] MANOR ROAD, AUSTIN, TEXAS

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Monday, June 1, 1987

New Grape Region

Texas Wine: Taste It and Believe It

By J. MICHAEL KENNEDY,
Times Staff Writer

LUBBOCK, Tex.—Napa Valley take note: Chateau de Bubba, vin du Lone Star, has arrived.

Up north of Lubbock, along a rutted dirt road, is a winery. As far as the eye can see around it—and that's forever on the Texas high plains—there's nothing but cotton fields and towns like New Deal and Idalou and Shallowater, but this is where a Texan named Bobby Cox is producing wine that would make Bacchus do back flips.

Drive south out of Lubbock and there's another winery, called Llano Estacado, which has, besides a high-sounding name, a passel of medals for excellence in its tasting room. These folks' Chardonnay won a double gold award (the highest) last year at the San Francisco Fair and Wine Competition. Only 11 such awards were given out in a comparison of 1,955 wines, including a bunch from California.

Bobby Cox's Pheasant Ridge label Cabernet Sauvignon won a gold medal in that same competition, and his Chardonnay is on the wine list at Spago in Los Angeles.

Chateau de Whom?

No winery is actually called Chateau de Bubba. That's just the Texans' way of acknowledging the humble surroundings of their high-falutin product. After all, this is wine from a place where hailstones come the size of golf balls and sandstorms can peel the paint off a car. It is also, however, a place of fine, sandy soil, hot days and cool nights—grape country.

"If this region had been settled by the Portuguese or Italians, there would be 500,000 acres of grapes [illegible] by a world-[illegible]

Associa...

Unidentified volunteer hides behind a fire truck as flames consume one of the Pebble Beach ho

Reagan Backs Routine Testing for AIDS Virus

He Cites 'Moral Obligation,' Asks Examinations for Marriage Applicants, Drug Abusers, Inmates

By MARLENE CIMONS, *Times Staff Writer*

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Hart a Reminder

New Cautio... Enters Live... of Legisla...

By JE... C...
Times Staff W...

SEPTEMBER 1991 • VOLUME 19 • ISSUE 9

TexasMonthly®

27

DANNY TURNER

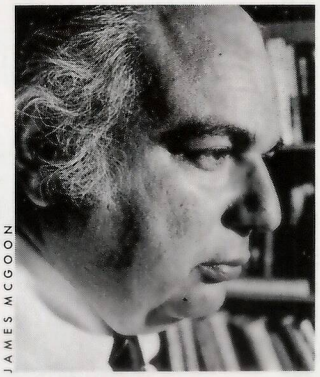
Albert Alkek hooked a fortune in oil and gas, page 114.

Departments

Miscellany

For subscription information, see page 186.

Features



JAMES MCGOON

The bargainer, page 102.

KEITH CARTER

Fashion that looks ahead to cooler weather, page 106.

Styling by Shannon Shapiro, assistant styling by Tamara Mewis, location courtesy of the Housetop Mountain Ranch, Marathon. Hat from Legends Trading Company, Santa Fe, New Mexico; black cat suit from Barneys New York, Houston and Dallas; boots from Ed Gage Antiques and Artifacts, Austin; coat from Spider Woman Designs, Santa Fe; earrings from Ortega's Turquoise Mesa, Santa

TEXAS PLAINS TRAIL

The Texas Plains Trail spans a vast area of the High Plains region of Texas. The tableland is called the Llano Estacado, an ancient Spanish term generally interpreted to mean "staked plains." Much of the Trail slices through what residents call the "Golden Spread," a reference to this immensely rich agricultural, mineral, and industrial region. Geographically this is the southernmost extension of the Great Plains of the United States.

Once the entire plains were grasslands. Not a fence was to be seen, not a single tree or shrub grew on the tablelands—only grass, as trackless as the sea. A branch of the great Comanche War Trail swept across the expanse, and herds of buffalo wandered at will. Man wiped out the buffalo and overstocked the range with cattle. Grazed too closely by cattle confined within fences, the immensely

Adapted and updated from the Trail Map series published by the State Department of Highways and Public Transportation

TexasMonthly

valuable tall native grasses were destroyed, leaving only the less desirable short species.

Not far below the surface, plentiful irrigation water is one source of nature's bounty in this region. Other subterranean treasures are reservoirs of oil and natural gas. Trail drivers often will see evidence of both resources as they follow the route laid out here.

Travelers on the High Plains can be sure of one thing: the land will be nearly table-flat except in areas where it has been disturbed by erosive influences. And therein lies some of the greatest geographical drama of the plains, since the erosion has carved spectacular canyon landscapes.

Because of space limitations in this supplement, descriptions are devoted mainly to interpretation of the driving routes. Before setting out, Trail drivers should acquire a free copy of the *Texas State Travel Guide*, which provides complementary details about many of the cities and towns along the route. An Official Highway Travel Map will also be useful. Both may be obtained by mail from the departmental address at the end of this supplement or at any Texas Travel Information Center.

For even more information about local accommodations, campgrounds, and tourist activities, visit the chambers of commerce and tourist offices listed in this supplement.

The starting point is the city of Lubbock, the major metropolitan area on the Trail. The route description is presented in a clockwise direction. However, the Trail is designed so that it may be started at any point and driven in either direction by carefully consulting the accompanying map and descriptive copy. See the map legend for information about special Trail signs and arrows.

LUBBOCK

Lubbock County
Pop. 186,206 Alt. 3,241

Viewing the broad, clean metropolitan area of Lubbock, it is difficult to believe that the city was founded as the result of a squabble between two land companies and that its early years saw little growth and many troubles with prairie fires, sandstorms, and droughts.

Lubbock today is one of Texas' major cities, a modern metropolis that has managed to retain neatness and order along with accelerating growth. A remarkable overall cleanliness is one of the first things visitors notice. Then the beauty of the broad, landscaped boulevards and modern businesses contributes its own pleasant effect.

Lubbock is the hometown of rock-and-roll star Buddy Holly, and a statue at the entrance to the civic center, at Eighth Street and Avenue Q, honors him. At the same location, "Walk of Fame" bronze plaques honor people from the West Texas area who have made significant contributions in the entertainment industry.

Lubbock Lake Archeological Site, at Loop 289 and North Indiana Avenue, is a national historic landmark. Interpretive center open 9 a.m.–5 p.m. Tue.–Sat., 1–5 p.m. Sun. Tours of archeological area only when work is in progress. Admission is charged.

Wine-tasting tours are available at all three Lubbock wineries. The Llano Estacado Winery, about 3 miles east of US 87 on FM 1585, has tours every half hour 10–4 Mon.–Sat. and 12–4 Sun. Teysha Cellars is south of Lubbock on Woodrow Road just east of US 87. Tours are 10–5 Tue.–Sat., noon–5 Sun., closed Mon. Named for the majestic wild birds spotted in the area, Pheasant Ridge Winery is a few miles north of Lubbock. From I-27, exit on FM 1729 and go 2 miles east and 1 mile south. Tours are 10–4 the second Sat. of each month or by appointment.

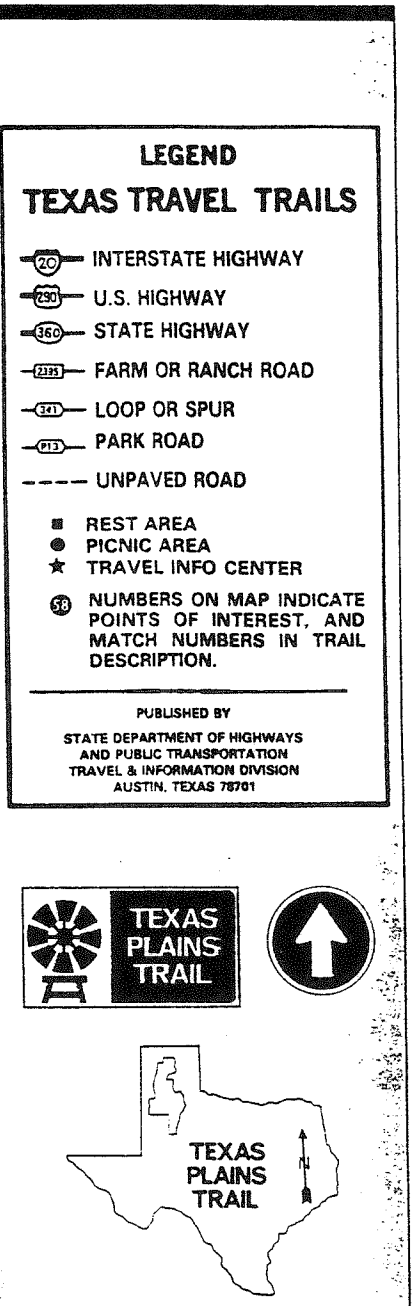
To get your Trail experience started off right, don't miss the Museum of Texas Tech University and the adjacent National Ranching Heritage Center, both of which offer a superb interpretation of what's in store—Panhandle history on an epic scale, the dramatic geography and geology of the region, and the state's foremost collection of pioneer ranch structures.

For full details on area attractions, visit the Lubbock Convention and Visitors Bureau, at 1120 Fourteenth Street, and consult the *Texas State Travel Guide*.

•

The Trail route leaving Lubbock offers views of many fine homes and landscaped gardens, passing Lubbock Christian College and Reese Air Force Base. ❶ Adjacent to the highway is a recreational lake and a golf course for the personnel of the fighter-training base.

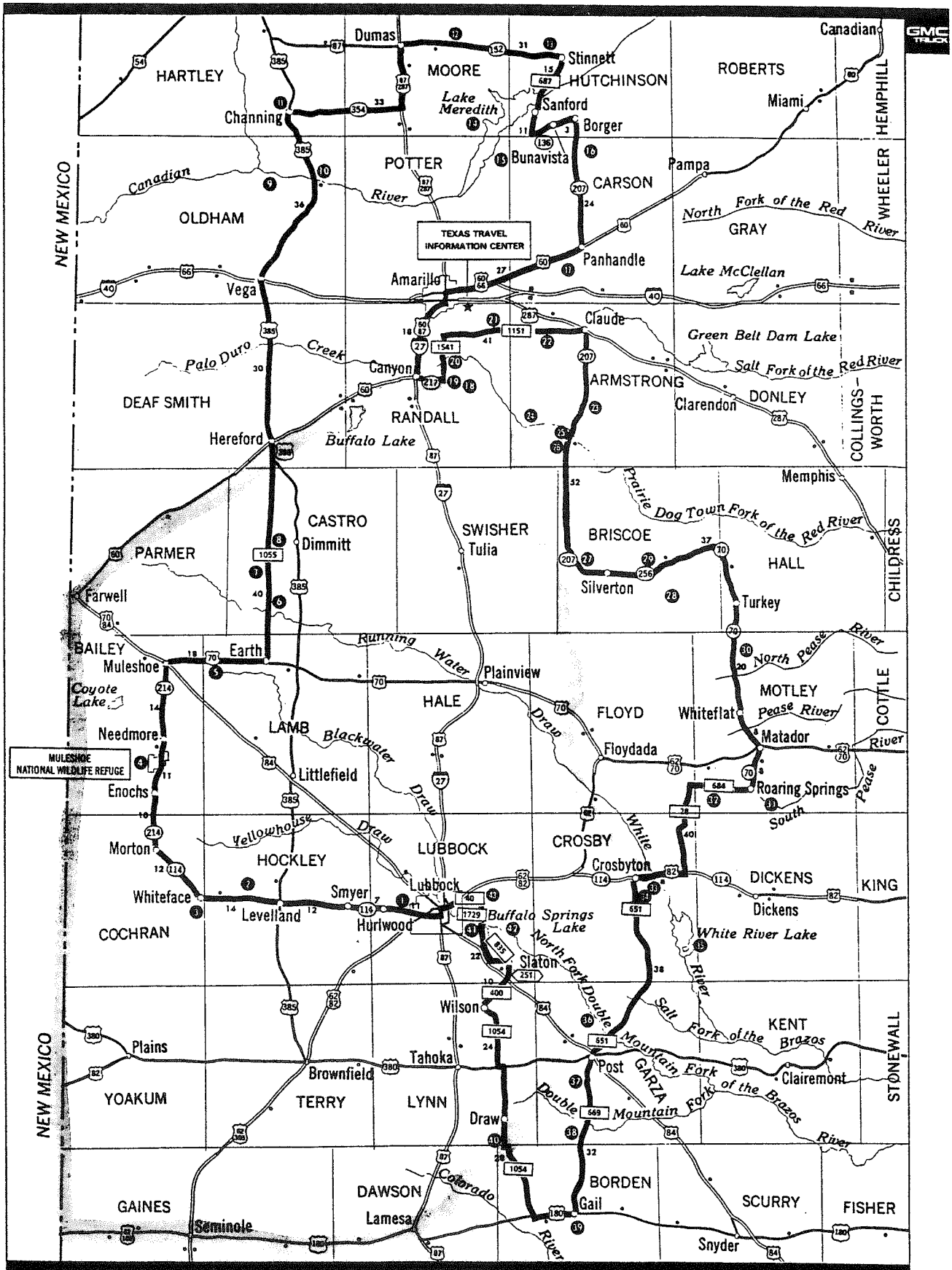
The large, two-bladed windmills that you will see along the air base entrance road, similar to others in the area, generate electric power primarily for pumping irrigation water.



Blue-and-white Travel Trail signs mark all Trail highways. The RECTANGULAR sign with Trail name and symbol identifies and confirms your route periodically. The ROUND arrow sign (used alone) guides you at intersections when the Trail changes highways, or at possible points of confusion. Consult your map often, and watch for those blue-and-white arrows.

Trails avoid major highways when possible, using instead many State Highways, Farm and Ranch Roads. In the text, "Texas" designates State Highways, "F.M." and "R.M." are Farm or Ranch Roads. All are fine paved routes you will enjoy driving.

Those traveling the Trail in this area will observe irrigation at nearly every hand. Several methods are used to water the fertile fields—ditches, long rows of pipe, and wheeled sprinkler systems. One



advanced sprinkler type is mounted on comparatively small rubber-tired wheels; it slowly rotates in huge circles, with special configurations that permit watering the corners of the field. Note that some methods employ sprays directed straight down, some throw rotating arcs like huge lawn sprinklers, and others aim lateral jets slightly above the horizontal.

The plains' intensive agriculture is utterly dependent on such irrigation, for rainfall is only 17 to 18 inches per year. Without irrigation, row-crop agriculture couldn't be sustained, and the plains would revert to natural grasslands.

2131 56th St.
Lubbock, TX 79412
August 14, 1992

Ms. Marjorie D. Ruhf
Coordinator, Wine and Beer Branch
Department of the Treasury
Bureau of Alcohol, Tobacco and Firearms
Washington, D. C. 20226

Dear Ms. Ruhf:

In answer to your letter of June 23, 1992 I have enclosed addenda numbered in order of survey. Addendum #1 contains a list of the growers on the High Plains with addresses and approximate acreage. (Note: a grower may plant his vines, 5' down a row with rows 8' apart; hence he may have over a 1000 vines per acre. Another grower may plant his vines 8' down a row with 12' rows and have 450 vines. Hence, tonnage per acre is not a true yield description).

None of the wineries would provide a list of growers from whom they buy grapes; however the ones marked are known to sell as indicated. If a circle with a radius of 50 miles were drawn from the wineries it would indicate 90% of the growers.

Addendum #2: The Texas Wine Marketing Research Institute gives a listing of 26 wineries. A list from Wines and Vines (professional publication) gives 30 wineries with their capacity. A booklet from the Texas Department of Agriculture lists 26 wineries with a map giving directions on how to get there. Using Wimberly Valley as an example, you will note that the owner buys grapes from all over the state.

Using the legend on pages 10-11 in the Texas Agriculture publication, Winery #1 is located in Amarillo a city of approximately 180,000. Such a location provides a better market. However, the grapes come from High Plains growers. Wineries 2, 3, and 4 are located near Lubbock, a city of 200,000. Pheasant Ridge, #2, is struggling since it was built in a "dry area" according to Texas laws and may not sell wine at the winery. Winery #7 has closed as it was built in a "dry area" and 100 miles from any large town. Thus #1 and #7 are the only two wineries close to the High Plains.

As was stated, acres and tons are not accurate criteria for yield prediction. The number of vines and pounds per vine would be a better measurement of yield.

Weather conditions over the High Plains vary from day to day and in some cases is very extreme. As one farmer said, "We get 15 inches of rain a year and you should be here the day we get it." The arctic winds can blow in as a "blue norther" and temperatures can drop from 60°F. to 0°F. with driving snow in a 24 hour period. If this occurs before the grape vines go into dormancy the grape producing buds for the following year will be frozen. Such a phenomenon occurred last October. A damaging hail can be expected once in 10 years. However, some growers have suffered from two or three hails in one year.

I have tried to include in the "Texas High Plains Area" the area most suitable for growing grapes. The land, a sandy clay loam, has a tendency to "blow" if the winds get over 20 mph. However, this wind drainage is highly desirable as it circulates through the vines making a micro-climate that produces an award winning wine.

The newspaper article appeared in 1974, early in the grape and wine industry of this area. In the 20 years that have lapsed a great deal of information has been compiled on growing conditions.

I apologize for such lateness in answering your letter. We have been on vacation for a month and just recently returned.

Sincerely yours,

Clinton M. McPherson

Clinton M. McPherson

Addendum # 1

County	Name	Acerage	Address	CityState	Cultivars
Cochran	J. W. Word	0.8	Box 225	Whiteface, TX 79379	CHBL VDLT GRSL
		0.8			
Crosby	Dale Rhoades	10.0	710 W. Main	Crosbyton TX 79322	?
		10.0			
Dawson	O.E.Hughlett	20.0	Box 11	Welch,TX 79377	PCHR CBSV
Dawson	Ronnie Wilson	100.0	113 Hillside Dr.	Lamesa,TX 79331	PCHR CBSV CBFR
		120.0			
Deaf Smith	Bill Dannevik	10.0	P.O. Box56	Dimmitt, TX 79027	
Deaf Smith	Loran Nixon	1.0	1209 Grand	Hereford,TX 79045	
		11.0			
Floyd	Thomas,	7.5		Lockney	
Floyd	Robert Lee Daniels	5.0	Box 767	Lockney,TX 79241	
Floyd	Breck M. Wofford	50.0	HCR4 Box 54	Lockney,TX 79241	WRSL
		62.5			
Garza	Drew Kirpatrick	5.0	1010 W. 10th	Post, TX 79356	
		5.0			
Hale	Freddy Bell	55.0	1306 Itasca	Plainview,TX 79072	PCHR ZINF CBFR PNNF
Hale	F.F. Calhoun	5.0	121 S.E. 7 th	Plainview, TX 79072	
Hale	Bobby and Jo Evan	20.0	Rt 1	Plainview TX 79072	
Hale	Joe Francis	26.0	HCO 1 Box 220	Plainview,TX 79072	
Hale	Robert E. Heath	50.0	4201 92nd	Lubbock,TX 79423	PCHR CBSV
Hale	Pete Laney	20.0	PO Dr 900	Hale Center TX 79041	WRSL PCHR
Hale	William N. Lipe	3.0	TAES	Texas A&M Center, Lubb	MANY
Hale	Hoyt Taylor	12.0	Rt 2 Box 151	Hale Center,TX 79041	WRSL PCHR
		191.0			
Hockley	Frank Beard	40.0	221 Cotton Wood	Levelland,TX 79336	SVBL PCHR CBSV CBF
Hockley	Ernest Shiflett	2.0	304 Cactus Dr.	Levelland,TX 79336	PCHR
Hockley	Cecil Stanley	30.0	Box 1249	Levelland,TX 79336	MUSB WRSL PCHR SV
Hockley	Jimmy L. Welch	5.0	Rt 3 Box 17	Levelland,TX 79336	
		77.0			
Lamb	Billy W. Clayton	60.0	Box 38	Springlake,TX 79072	WRSL PCHR CBSV CHI
Lamb	Toni & Robert Meir	4.0	Rt 1 Box 39	Olton, TX 79064	WRSL
Lamb	Jerry Meyer	10.0	813 W 16th	Abernathy,TX 79311	PCHR
Lamb	Arthur Summers	15.0	Box 346	Littlefield,TX 79339	CBSV SVBL
Lamb	Larry Wade	10.0	Rt 2 Box 96	Littlefield,Tx 79339	
		99.0			

County	Name	Acerage	Address	CityState	Cultivars
Lubbock	A.R.C. Vineyards	100.0	Box 271	Lubbock ,TX 79408	PCHR CBSV CBFR MU
Lubbock	Grady Baze	12.0	Rt 8, Box 119	Lubbock, Tx. 79407	
Lubbock	Dennis Bednarz	6.0	Rt 2 Box 24A	Slaton,TX79364	
Lubbock	Darrell Boepple	2.0	Rt 3 Box 858	Lubbock,TX 79401	CBSV
Lubbock	Don Brady	5.0	P.O. Box 3487	Lubbock,TX 79452	
Lubbock	Bill Brown	10.0	4617 94th	Lubbock, TX 79424	PCHR
Lubbock	Jack Burkett Jr.	2.0	8016 Ruxgnibs c	Lubbock, TX 79424	PCHR
Lubbock	Garvin Cooper	6.0	Rt 1 Box 49B	Ropesville,TX 79358	?
Lubbock	Bobby Cox	40.0	Rt 3 Box 191	Lubbock,TX 79401	PCHR SVBL SEMI CHB
Lubbock	Paul Crosnoe Jr.	35.0	Rt 2 Box 218	Lubbock,TX 79401	CHBL SVBL CBSV CBF
Lubbock	Jolene & Wayne Da	4.0	6705 63rd	Lubbock, TX 79424	CBSV
Lubbock	Morton S. Dismuke	7.0	312 York Ave	Lubbock,TX 79416	MERT
Lubbock	Gary George	10.0	5149 69th	Lubbock, TX 79424	CBSV
Lubbock	J. C. Goble	5.0	Rt 3 Box 171	Lubbock, TX 79401	
Lubbock	Bob Green	17.0	3712 70th	Lubbock, TX 79413	CBSV CHBL
Lubbock	Allen Hagens	13.0	Rt 10 Box 243	Lubbock,TX 79404	GWTZ WRSL
Lubbock	Lynn Harrist	3.0	Rt 1	Shallowater,TX 79363	CBSV
Lubbock	Phil Harrist	2.0	Rt. 4, Box 753	Lubbock, TX 79424	CBSV
Lubbock	Leroy Hildebrand	2.0	Rt 3 Box 33	Slaton,TX 79364	PCHR
Lubbock	Jerry Jenkins	40.0	Rt 2, Box 199	Lubbock,TX 79415	PCHR PNNR CBFR CBS
Lubbock	William N. Lipe	3.0	TAES	Texas A&M Center, Lubb	MANY
Lubbock	Chester Marston	0.5	1304 49th	Lubbock,TX 79412	SVBL
Lubbock	Clinton McPherson	13.0	2131 56th	Lubbock,TX 79412	CBSV SVBL PCHR
Lubbock	Jean Nichols	1.0	Rt 2 Box 169	Idalou,TX 79329	?
Lubbock	Bill Oden	10.0	2302 Slide Rd.#	Lubbock,TX 79407	PNNR
Lubbock	Harold Peikert	4.0	Rt 1 Box 447	Wolfforth,TX 79382	CBSV PCHR
Lubbock	Scott Slaughter	40.0	107 RR 620 Sout	Austin,TX 78734	PCHR CBSV RBCB CHE
Lubbock	Cecil Sluter	0.3	3010 67th	Lubbock,TX 79413	
Lubbock	Robert Stites	110.0	4702 67th	Lubbock, TX 79414	PCHR CBSV CBFR SVE
Lubbock	Jeff Stuyt	2.0	P.O. Box 4285	Lubbock, TX 79409	PNNR
Lubbock	Charles Votava	3.0	4502 11th	Lubbock,TX 79416	
Lubbock	Chris Winn	1.0	2314 23rd	Lubbock, TX 79410	?
Lubbock	Wayne Worley	3.0	4602 30th	Lubbock,TX 79410	CBSV
		511.8			
Lynn	Steven O. Cole	3.0	2810 22nd	Lubbock,TX 79410	?
Lynn	Lewis Spears	0.3	Rt4 Box 160	Tahoka,TX 79373	
Lynn	Richard Wright	100.0	Box 1550	Tahoka,TX 79373	CHBL GWTZ PSIR PCH
Lynn	James Wuensche	3.0	Rt 1 Box 152	Wilson,TX 79381	
		106.3			
Swisher	Terry McEachern	1.0	Star Rt.	Kress,TX 79052	?
		1.0			
Terry	Jerry Bradley	2.0	1308 E. Hester	Brownfield,TX 79316	WRSL CBSV

County	Name	Acerage	Address	CityState	Cultivars
Terry	A. R. Brownfield	4.0	P.O. Box 947	Lubbock,TX 79416	WRSL
Terry	Tim Elkner	2.0	AHE Dept, MS 21	TTU Campus	MANY
Terry	Doyle Floyd	2.0	Rt 4	Brownfield,TX 79316	WRSL CBSV
Terry	Bob Gibson	15.3	Box 283	Meadow, TX 79345	CBSV PCHR
Terry	C. J. Thomason	3.0	Rt 2 Box 134	Brownfield, Tx 79316	WRSL CBSV
Terry	Bobby Young	5.0	Rt 1	Brownfield, Tx 79316	MUSB PNNR
		33.3			
Yoakum	Buster Graham	2.0	Box 600	Plains, TX 79355	PCHR
Yoakum	Doyle Newsom, Jr	18.0	Box 59	Plains, Tx 79355	PCHR CBSV
Yoakum	Neal Newsom	5.0	Box 540	Plains,TX 79355	
		25.0			
		1253.7			

L = LLANO ESTACADO
T = TEYSHA (OR NOW CAP ROCK
P = PHEASANT RIDGE

#2

July 1992

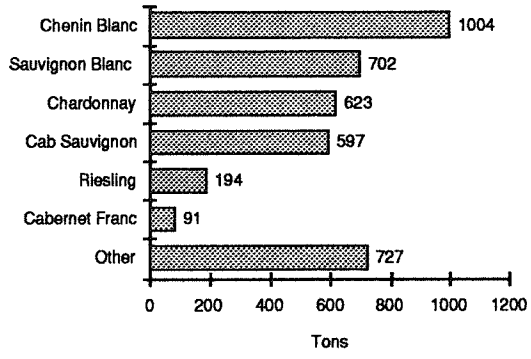
Texas Wine & Wine Grape Industry Fact Sheet

Compiled by the Texas Wine Marketing Research Institute • Texas Tech University • PO Box 41162 • Lubbock, Texas 79409-1162 • Ph. (806) 742-3077 • Dr. Steve Morse • Director

The Texas wine industry had its beginnings over 300 years ago. In 1662, Spanish missionaries planted grape rootstock at the Ysleta Mission near El Paso to produce sacramental wine. Since then, the industry has gone through many changes. By 1900, over 25 Texas wineries sold wine within the state. However, all legal wine production was halted during Prohibition (1919-1933). The growth of the modern wine industry began in the 1970s when the "wine revolution" reached Texas. The industry has again emerged as an important part of the Texas economy.

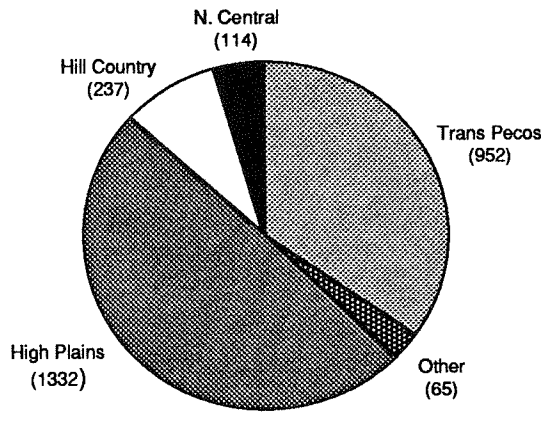
Texas Wine Grape Production Facts

Texas Wine Grape Production by Variety (Tons), 1990



- The number of acres of wine grape production on the high plains area accounts for 49 percent of all the wine grapes produced in Texas; 35 percent of the production is from the Trans Pecos region and 9 percent comes from the Texas Hill Country.
- Texas currently has three designated viticultural areas as appellations of origin: (1) Bell Mountain Viticultural Area, (2) Fredericksburg in the Texas Hill Country Viticultural Area, and (3) the Texas Hill Country Viticultural Area.
- Texas has a total of 2,700 producing acres of wine grapes.

Wine Grape Producing Areas in Texas (Acres), 1990



Texas Legal Facts

- Of the 254 counties in Texas, 57 are wholly dry, 181 allow some sort of sale of distilled spirits, 12 counties allow 4 percent beer only, and 4 allow alcoholic beverages of 14 percent or less.
- Unlike other wine producing states, Texas wineries are not allowed to sponsor tastings outside their winery.

Economic Impact on the Texas Economy

The 1991 Texas wine and grape industry had the following economic impacts on the Texas economy:

Total Economic Impact:	$96.7 million
Employment Impact:	added 2,430 jobs for Texans
Income Impact:	added $17.1 million to Texas paychecks
Tax Impact:	added $1.8 million in direct sales tax, $197,000 in direct excise tax, which together had a multiplier effect of $5.6 million on the Texas economy.
Value Added Processing:	Texas winemakers added $11 million to the value of Texas wine grapes. This value added processing of wine grapes took place in Texas, thus employing Texans.

Award Winning Wines of Texas

Texas wines have won numerous gold medals at national and international wine competitions. The Texas varietal wines that have been successful at winning major competitions include:

- Chardonnay
- Cabernet Sauvignon
- Gewürztraminer
- Sauvignon Blanc
- Chenin Blanc
- Johannisberg Riesling
- Carnelian

In addition, Texas generic wines have won many national and regional competitions.

Texas Wine Production Facts

- Texas is the 6th largest wine producing state in the U.S.
- The oldest existing winery in Texas is Val Verde Winery, located in Del Rio and established in 1883.
- Since 1986, Texas wine production has more than doubled to 1.1 million gallons in 1991.
- The four largest Texas wineries produce 81 percent of all wine produced within the state.

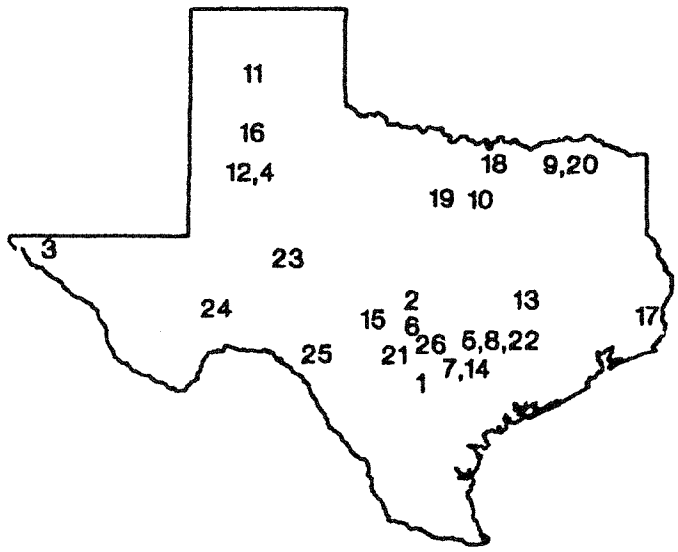
Texas Wine Production and Number of Wineries, 1975 - 1991

Year	Wine Produced (Gallons)	Number of Wineries
75	6,000	2
76	10,000	3
77	11,000	3
78	19,000	4
79	26,000	5
80	37,000	6
81	38,000	8
82	47,000	12
83	130,000	14
84	363,000	17
85	455,000	17
86	500,000	19
87	550,000	18
88	591,000	20
89	653,000	25
90	943,000	26
91	1,100,000	26

Wine Consumption Facts

- Table wine consumption in Texas has increased by nearly 5 percent from 1989 to 1990, while U.S. consumption increased by less than 1 percent.
- By volume, 80 percent of wine in Texas is sold off-premise (supermarkets, liquor stores), while 20 percent is sold on-premise (restaurants, bars).
- Table wine imported from overseas accounts for 17 percent of table wine sales in Texas.
- Texas wine accounts for approximately 2 percent of all wine sold within the state.
- In the U.S., Texas ranks 30th in wine consumption per adult, with 2.39 gallons per adult. The U.S. average is 2.96 gallons.
- Table wine consumption accounts for 56 percent of all wine sold within Texas. This is followed by wine coolers at 31 percent, sparkling wine at 6 percent, and dessert and fortified wine at 7 percent.

Location of Texas Wineries



1. **Alamo Farms Winery & Vineyard** ***(Adkins)*** • Amy Pruski, Owner • Route 2, Box 924 • Adkins, TX 78101 • Ph. (512) 947-3331
2. **Bell Mountain/Oberhellmann Vineyards** ***(Fredericksburg)*** • Bob & Evelyn Oberhelman, Owners • HC 61, Box 22 • Fredericksburg, TX 78624 • Ph. (512) 685-3297
3. **Bieganowski Cellars** ***(El Paso)*** • Victor & Arthur Bieganowski, Owners • 5923 Gateway West • El Paso, TX 79925 • Ph. (915) 775-0842
4. **Cap-Rock Winery** ***(Lubbock)*** • Jim Stiles, Director of Operations • Route 6, Box 713K • Lubbock, TX 79423-9744 • Ph. (806) 863-2704
5. **Fall Creek Vineyards** ***(Tow)*** • Ed & Susan Auler, Owners • 1111 Guadalupe Street • Austin, TX 78701 • Ph. (512) 476-4477
6. **Grape Creek Vineyards** ***(Stonewall)*** • Ned E. Simes, President • PO Box 102 • Stonewall, TX 78671 • Ph. (512) 644-2710
7. **Guadalupe Valley Winery** ***(Gruene)*** • Larry & Donna Lehr, Owners • 1720 Hunter Road • New Braunfels, TX 78130 • Ph. (512) 629-2351
8. **Hill Country Cellars** ***(Cedar Park)*** • Fred H. Thomas, Owner • PO Box 26146 • Austin, TX 78755-0146 • Ph. (512) 259-2000
9. **Homestead Winery** ***(Ivanhoe)*** • Gabe & Barbara Parker, Owners • PO Box 35 • Ivanhoe, TX 75447 • Ph. (903) 583-4281
10. **La Buena Vida Vineyards** ***(Ft. Worth)*** • Bobby G. Smith, Owner • WSR, Box 18-3 • 650 Vineyard Lane • Springtown, TX 76082 • Ph. (817) 523-4366
11. **La Escarbada XIT Vineyard & Winery** ***(Amarillo)*** • Art Reinauer, President • 200 Plaza Lane • Amarillo, TX 79118 • Ph. (806) 622-3932
12. **Llano Estacado Winery** ***(Lubbock)*** • Walter M. Haimann, V. Chairman & COO • PO Box 3487 • Lubbock, TX 79452 • Ph. (806) 745-2258
13. **Messina Hof Wine Cellars** ***(Bryan)*** • Paul & Merrill Bonarrigo, Owners • Route 7, Box 905 • Bryan, TX 77802 • Ph. (409) 778-9463
14. **Meyer Champagne Company** ***(New Braunfels)*** • Henri Bernabé, Owner • 3939 IH-35 South, Suite 209B • San Marcos, TX 78666 • Ph. (512) 396-1600
15. **Pedernales Vineyards** ***(Fredericksburg)*** • Karl & Judy Koch, Owners • HC 12, Box 70AA • Fredericksburg, TX 78624 • Ph. (512) 997-8326
16. **Pheasant Ridge Winery** ***(Lubbock)*** • Bobby & Jennifer Cox, Winegrowers • Route 3, Box 191 • Lubbock, TX 79401 • Ph. (806) 746-6033
17. **Piney Woods Country Wines** ***(Orange)*** • Alfred J. Flies, Owner • 3408 Willow Drive • Orange, TX 77630 • Ph. (409) 883-5408
18. **Preston Trail Winery** ***(Gunter)*** • Tom & Tiffany Greaves, Don & Ruby Prescott, & Charles & Jimmie Britt, Owners • Route 1, Box 77A • Gunter, TX 75058 • Ph. (903) 433-1040
19. **Sanchez Creek Vineyards** ***(Weatherford)*** • Ronald Wetherington, President • DSR, Box 30-4 • Weatherford, TX 76086 • Ph. (817) 594-6884
20. **Schoppaul Hill Winery** ***(Ivanhoe)*** • Dr. John R. Anderson, Owner • PO Box 77 • Ivanhoe, TX 75447 • Ph. (903) 583-2846
21. **Sister Creek Vineyards** ***(Sisterdale)*** • Vernon C. Friesenhahn, Owner • Route 2, Box 2481 C-1 • Sisterdale, TX 78006 • Ph. (512) 324-6704
22. **Slaughter Leftwich Vineyards** ***(Austin)*** • Scott Slaughter, President • 107 RR 620, Box 22F • Austin, TX 78734 • Ph. (512) 266-3331
23. **St. Lawrence Winery** ***(Garden City)*** • Jerome F. Hoelscher, Owner • HC 63, Box 81-B • Garden City, TX 79739 • Ph. (915) 397-2226
24. **Ste. Genevieve Wines** ***(Ft. Stockton)*** • John Collet, President • 85 NE Loop 410, Suite 217 • San Antonio, TX 78216 • Ph. (512) 366-4961
25. **Val Verde Winery** ***(Del Rio)*** • Tommy M. Qualia, Owner • 100 Qualia Drive • Del Rio, TX 78440 • Ph. (512) 775-9714
26. **Wimberley Valley Wines** ***(Driftwood)*** • Dean Valentine, V. President & Winemaker • Route 1, Box 65 • Driftwood, TX 78619 • Ph. (512) 847-2592

Grapes May Becor
Cash Crop In Are

NEW SOUTH PLAINS ROW CROP—Dr. R. E. Mitchell, Dr. Clinton McPherson and Robert Reed, all members of the Llano Estacado Winery board, check progress of grapes on their experimental acreage. (Staff Photo by Gerry Burton)

(Continued From Page One)

orchard.

"I put it in the back yard for an ornamental to shade the patio in 1962 and had grapes in 1966," Robert Reed, assistant professor of horticulture and entomology at Tech, explained.

Yield from the one plant —now 240 pounds per year — resulted in experimental wine-making by Reed and a friend, Dr. Clinton McPherson, assistant professor of chemistry.

"In 1969 we started thinking about grapes and the resulting wine as a cash crop, a side crop for South Plains farmers." Reed added.

First planting was March, 1971. With two years needed for grapes, three for a crop and four for an established yield, next year will be the telling season for the first planting.

Successive plantings involving more than 100 varieties are testing what will grow best, produce best under South Plains weather conditions.

"The chemistry aspects of wine-making are fascinating and I thought it a good deal for this part of the country," Dr. R. E. Mitchell, also a Tech assistant professor of chemistry said of his joining the venture. He has his own vineyard.

A banker, Jim Crenshaw, and an attorney, Harry Harriger, make up the rest of the directors. The board has "about $25,000 tied up" in the project so far. This includes trips to California seminars on grapes.

Labor in the vineyard is a part of the investment. After work and on weekends the business men mount tractors, man hoes and "get to know each vine" in their work for the future.

They've done "complete basic research" on what kind of product will come from South Plains soil.

A state grant for testing research helped one year. This year facilities and space at Tech are the only outside aids.

"We have to buy grapes two years before we can go into production," McPherson said. The directors expect a return on their investment only after the product is marketed.

Pride in a South Plains product will be a big factor as well as a "backyard" blend to include any surplus grapes for sale on the South

So far, a straight from that first grape pleases tasters most.

They call it "patio cause its proper nam lost long ago.

It is a French-Am hybrid purchased fr Kansas nursery long business.

Grape experts have unable to determine the leaf or the grape variety of hybrid it is.

It remains the grape.

"Patio" probably w among the first and popular label on prod the Llano Estacado some day.

—LUBBOCK AVALANCHE-JOURNAL— Sunday Morning, July 14, 1974

OUTLOOK—Vineyards sprouting on the pinting, hopefully, toward a new cash crop ft. Dr. William Lipe of the A&M Extension Service checks table grapes now ripe against a heavily loaded vine of wine grapes which will ripen later this summer. At right, Robert Reed, a director of the Llano Estacado Winery, shows a promising young vine's crop to his daughter, Cathy. Other large projects are underway at Morton and Seagraves. (Staff Photos)

PURPLE PLAINS

Grapes Loom As Area Cash Crop

By GERRY BURTON
Avalanche-Journal Staff

CONTAGIOUS optimism about wine grapes as a cash crop is bubbling up on the South Plains.

One to three acre vine-